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DECEMBER 8, 1987

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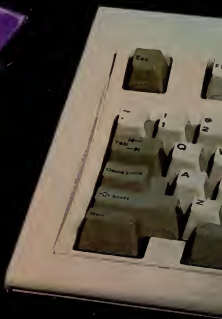
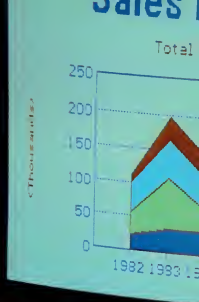


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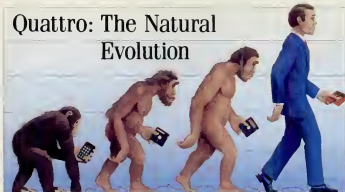
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WHAT'S INSIDE

We've said it before and we'll say it again. The single biggest productivity booster for your PC is a hard disk. And now there's no excuse not to buy one—hard disk cards make adding mass storage easy, mail-order companies make it cheap. And while these options once meant compromise, that's not the case anymore.

Improvements in hard disk cards have pushed average access times up to par with conventional hard disk systems. Hard disk card capacities are as high as 50 megabytes, and prices run as low as \$369. These improvements have sprung from the maturation of technologies involved in making the 3½-inch hard disks on which the cards are based and have been spurred along by the development of tiny computers like IBM's PS/2 series. In "The No-Sweat Way to Pump Up Your PC: Hard Disk Cards," on page 205, we'll show you how these new features are implemented in 15 new cards.

Mail-order companies offer prices as low as \$320 for a 20-megabyte drive and \$485 for a 30-megabyte drive. And as long as you take the proper precautions, chances are that you'll be satisfied with your purchase. In "The No-Sweat Way to Pump Up Your PC: Mail-Order Hard Disks," on page 241, we also report the results of our own experiences in ordering hard disks from five of the largest mail-order companies—and give you tips on how to navigate mail-order channels.

Low cost and ease of use are also the themes of our special report on CADD (computer-aided design and drafting)



Joel N. Orr headed the team of experts that tested the capabilities of low-cost CADD packages.

packages costing less than \$500. In "Upwardly Mobile CADD," on page 93, Joel N. Orr and other experts look at how close low-cost CADD packages come to the capabilities of the de facto standard, *AutoCAD*, which costs nearly \$3,000 and can be customized for any application.

Sometimes DOS makes it difficult to be productive, especially when it comes to hard disks. Files creep into the wrong sub-directories, multiply, clutter up DIR listings, and eat up disk space. On top of all that, making selected backup copies to floppy disks can take hours and try anyone's patience. Unless you have a copy of *PC Magazine's CO.COM* handy.

CO.COM sorts your directories and makes it easy to scan through and identify (or "tag") the files you want copied, moved, or deleted. Then a single keystroke does all the dirty work for you. You'll find this utility to be indispensable.

In this issue's After Hours, we report on a service that supplies timely reports on mutual-fund performance. It's a good place to start researching your next investment.

PC Magazine is the Independent Guide to IBM Standard Personal computers (PS/2). (PS/2) is published bi-monthly except in July and August for \$19.97 for one year (12 issues). \$49.97 for two years, and \$89.97 for three years. Additional postage \$1.00 per copy or \$12.00 per year for C-study and all other foreign countries. Ziff-Davis Publishing Co., address of Ziff Communications, Inc., One Park Ave., New York, NY 10016. Second class postage paid at New York, NY 10016 and at additional mailing offices. POSTMASTER: Address changes to PC Magazine, P.O. Box 3000, Hightstown, NJ 08520.



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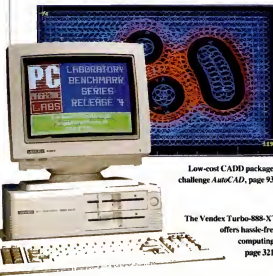
COVER STORY

The No-Sweat Way to Pump Up Your PC: Hard Disk Cards

Winn L. Rosch/ Hard disk cards are no longer only specialty items for the fumble-fingered with money to burn. The latest products feature improved performance and increased capacity as well as lower prices. What's more, these easy-to-install systems are small enough to slide into the IBM PS/2 Model 30, something conventional hard disk drives just can't do.... 205

The No-Sweat Way to Pump Up Your PC: Mail-Order Hard Disks

Walt Rowinsky/ Ordering your hard disk by mail is less risky than you may have thought. In fact, shopping by mail can save you time and money, if you follow the advice offered here. For a look at what you can expect before you order, we reviewed the sales and support services of five mail-order companies and tested their best-selling 20- and 30-meg hard disk packages..... 241



Low-cost CADD packages challenge AutoCAD, page 93.

The Vendex Turbo-888-XT offers hassle-free computing, page 321.

FEATURES

GRAPHICS

Upwardly Mobile CADD
Joel N. Orr/ How well do CADD packages costing less than \$500 measure up to the current industry standard, AutoCAD? To find out, we examined the full range of capabilities of 16 low-cost contenders. Some of these packages try to compete with AutoCAD by offering extensive features for production drafting applications, while others promise ease of use for those whose needs are less demanding..... 93

WORD PROCESSING

The Latest Word
Edward Mendelson/ Yes, Microsoft Word is still a little quirky, but the latest release, Version 4.0, has finally acquired all the tools it needs for the real world of word processing. The new Word meets the critics head-on with added flexibility and speed and better keyboard alternatives for all those users who don't yet rely on a mouse..... 289

CONNECTIVITY

Making Connections: Two E-Mail Systems for LANs
Frank J. Drefler, Jr./ Electronic-mail programs for LANs smooth communication within work groups, improve productivity, and eliminate telephone tag. But how many users does a program service? Does it flag priority mail? And how is its text editor? We ask these and other tough questions of cc:Mail LAN Package and The Network Courier Inter-
Network Version..... 303

COMPUTERS

Packaged Computers for No-Pain Computing
Richard Aaron/ These five computers from Acer, Cordata, IBM, Vendex, and Zenith are ideal for the legions of small-business owners, students, and first-time PC users who want a compact, low-cost, no-hassle system that can be run right out of the box..... 321

THE PRICE WATERHOUSE REPORT

SouthWare Takes the Future into Account
G. William Dauphinais, Timothy J. Lee, and Barbara J. Mullins/ A flexible, integrated accounting package that can run on XT's, LAN's, and minicomputers, the SouthWare Business Series will appeal to the business owner, accountant, or auditor who has sophisticated needs and ambitious growth plans.... 343

DATABASE MANAGEMENT

dBASE Report Writers: A Better Way
Glenn A. Hart/ The limited functionality of the report writer included with Ashton-Tate's dBASE III Plus makes it a poor tool for creating reports or developing applications quickly and cost-efficiently. But these ten products from third-party software vendors can bring the power and complexity of a sophisticated report writer to your dBASE data files..... 353

Cover Photograph:
Les Morsillo

FIRST LOOKS

Hands On:

- Borland's \$199 spreadsheet *Quattro*
- Microsoft's latest language update, QuickBASIC 4.0
- Awesome I/O Card hard disk accelerator
- Rodime's Double Play solves two problems for the slow IBM PS/2 Model 50 hard disk drive
- Bitstream fonts
- *The Soft Font Manager*
- Two 1-2-3 add-ins that tie into databases: *D.A.V.E.* and *Deja!*
- V.M. Personal Computing's *Beyond BAT*
- *The Norton Guides*
- Instant Yellow Page Service, [an on-line database](#) 33

AFTER HOURS

Hands On:

- The Source's CDA financial database
- *Personal Ancestral File*
- *Nemesis* . . . *The Go Master*
- Mark Wilson's *Build Yourself a Generic Computer* home video
- Gessler Educational Software's *R.S.V.P.*
- *Micro Kitchen Manager*
- Jackson Software's *Studymate* 578



PRODUCTIVITY

PC LAB NOTES

Creating and Using Program Libraries

Mark Novisoff/ Using a library to store routines that your programs share in common will save you time developing new applications and make your old programs run faster 379

UTILITIES

The Compleat Copy Utility

Michael J. Mefford/ CO will copy, move, or delete all the files you tag in its directory display, fill up the target disk with as many files as possible, and let you change disks 397



ENVIRONMENTS

Upward Compatibility Through FAPI

Charles Petzold/ Not ready to desert DOS yet, OS/2 makes provision for upward and backward compatibility 435

POWER PROGRAMMING Building on a Sound Structure

Ray Duncan/ Careful structuring of assembly language programs and naming of variables help avoid the spaghetti code that gives other programmers grief 447

SPREADSHEET CLINIC

Jared Taylor/ Adding helpful warnings to dangerous macros; cross-multiplying *Framework* ranges; slamming the brakes on *autoexec* macros 461

USER-TO-USER

Paul Somerson/ DOS batch file utilities that add pizzazz to your text displays; software guaranteed to toggle your shift status 467

POWER USER

Craig L. Stark/ Calamitous error-trapping failures in *dBASE III Plus*; listing a *dBASE* file's structure inside DOS; Word checking of word spelling 477

LANGUAGES

Robert L. Hummel/ A banner-building BASIC program; QuickBASIC library tips; a Turbo Pascal program that knows its trillions from its billions 485

PC TUTOR

Robert L. Hummel/ How old 8088 defects can stack up against you; printer ports and addresses; bordering on the colorful for the EGA 491

CONNECTIVITY CLINIC

Frank J. Derfler, Jr./ Making a network server do time-consuming compiling chores while you and your PC are free to whiz along 499

VIEWPOINTS

LETTERS TO

PC MAGAZINE 17

PC ADVISOR

Mitt Jones/ Selecting a print spooler, finding products for the PCjr, and using the Dvorak keyboard 27

FROM THE EDITOR'S SCREEN

Bill Machrone/ Getting Personal 65

JOHN C. DVORAK

CD-ROM Now! 71
[Inside Track](#) 73

JIM SEYMOUR

CD-ROMs: Who's Been Sleeping? 77

STEPHEN MANES

ConFusion '88: You're Not Alone 85



PC Magazine

Help File 391
Direct Marketing
[Connection](#) 509
Marketplace 531
Editorial Product
[Index](#) 564
[Coming Up](#) 565
Advertisers' Product
[Index](#) 567
[Index to Advertisers](#) 568
[Reader Service Card](#) 569



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The *Feature Stories* in *PC Magazine* are designed to be the most complete product evaluations in the industry. Months of planning and research go into each issue. But products are considered for review only if we know about them, so keep the features staff informed of your latest products. Contact: Bill Howard, Executive Editor, (212) 503-5283; Carol Ellison, Associate Editor, (212) 503-5265; Nora Georgias, Associate Editor, (212) 503-5267; Cheryl J. Goldberg, Associate Editor, (212) 503-5270; Robbin Juris, Associate Editor, (212) 503-5282.

PRODUCTIVITY

Each issue of *PC Magazine* contains five programs, tutorials, user tips, and applications advice to help our readers gain technical proficiency. We're very interested in receiving user tips (on disk, please) and are eager to hear from assembly language programmers who can help us develop useful *PC Magazine* utilities. Unfortunately, because of the large volume of mail, we can't acknowledge or respond to all submissions. Contact: Paul Somerson, Executive Editor, (212) 503-5275; Robert L. Hummel, Senior Technical Editor, (212) 503-5292.

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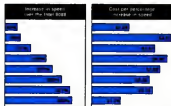
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Accelerator Cards: Speed and Value

Speed figures are consolidated results from 10 tests of CPU performance (See Accelerator Boards Special Report, December 1, 1986)

<input type="checkbox"/> Microspeed Fast 88	\$149
<input type="checkbox"/> Microsoft Mach 30	\$395
<input type="checkbox"/> Univation Dream Board	\$512
<input type="checkbox"/> Orchid Turbo EGA	\$945
<input type="checkbox"/> ST&D Standard 286	\$995
<input type="checkbox"/> Classic Speedpack	\$995
<input type="checkbox"/> Orchid PC-Turbo 286c	\$1,195
<input type="checkbox"/> Breakthru 286-12	\$595



REPRINTED FROM INFOWORLD, APRIL 27, 1987

Breakthru 286-8MHz-\$395
Breakthru 286-12MHz-\$595

LIGHTNING™—FREE with Breakthru speedup hardware—\$89.95 purchased separately

We are excited about our three speedup products. You probably know about our Lightning disk access speedup software that was awarded PC Magazine's Best of 1986 award (see box). After the smashing success of Lightning, in late '86, we

guaranteed the Breakthru 286 board to be literally the most advanced, fastest, most feature-rich board available. The runaway success it has enjoyed truly proved that assertion. Now we go ourselves one better with the Breakthru 286-12. This new board has the clock speed cranked up from 8 to 12 MHz for speeds up to 10.2 times faster than an IBM PC. It is 50% faster than an 8MHz IBM AT, and up to a whopping 1,000% faster than a regular PC.

HERE'S WHY THESE TWO BOARDS ARE SO SPECIAL.

First, they install so easily. A half-slot card means you don't even have to give up a full slot. What's more, unlike competing

products it works in the Compaq Portable and most clones. Easy diagrams show how you just place the card in an open slot, remove the original processor and connect a single cable. There is no software required. From that moment you are running faster than an AT.

Second, they are advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. Has a 80287 math coprocessor slot for numeric intensive applications. A 16K cache memory provides zero-wait-access to the most recently used code and data. Speed switching software allows you to drop back to a lower speed on the fly for timing sensitive applications.

Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Faster and smarter than an AT - PCSG guarantees it.

Fourth, these are the best. There are several other boards on the speedup market. We at PCSG have compared them all, but there simply is no comparison. Many cards offer only a marginal speedup in spite of their claims and others are just poorly engineered.

We are really excited about these products. PCSG makes the unabashed statement that the BREAKTHRU 286 card represents more advanced technology than boards by Orchid, Quadram, PC.

Technologies, Phoenix...we could go on. Breakthru 286 is undisputedly the turbo board with the biggest bang for the buck. And we include FREE the \$89.95 acclaimed Lightning software. Call today with your credit card or COD instructions and we will ship your card the very next day.

But, no speedup board cuts disk access time in half

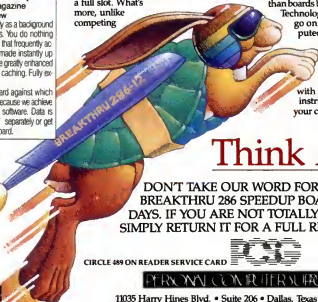
LIGHTNING

software can \$89.95 or FREE w/Breakthru

"Lightning is almost mandatory..." - Steve Manes, PC Magazine Best of 86 review

Loads with the DOS - always ready as a background program to accelerate disk access. You do nothing - everything is automatic. Programs that frequently access the disk (hard or floppy) are made instantly up to 2 to 4 times faster. Uses a principle greatly enhanced from mainframe technology called caching. Fully exploits Auto Board memory.

LIGHTNING is the standard against which all our competition measures itself because we achieve universal compatibility with other software. Data is never lost. Order LIGHTNING separately or get it free with your Breakthru 286 board.



Think Again.

DON'T TAKE OUR WORD FOR IT. USE EITHER BREAKTHRU 286 SPEEDUP BOARD FOR 60 DAYS. IF YOU ARE NOT TOTALLY SATISFIED SIMPLY RETURN IT FOR A FULL REFUND.



CIRCLE 689 ON READER SERVICE CARD

PERSONAL COMPUTER SUPPORT GROUP

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Everyone who tries it, tells us, "It's the best there is."

Don't take our word for it. Use Lucid 3-D for 60 days. Return it for a full refund if not completely satisfied. Plus, instead of the \$199 list price, an introductory spread-the-word price of \$99.

Lucid 3-D is priced to sell at \$199, but we want thousands of people using Lucid everyday, all over the world. We invite you to be a part of that group. The reason we are offering Lucid for only \$99, on a sixty day return for a full refund, is simple. Preliminary user testing of the product produces the same results over and over. People tell us they would never work without Lucid 3-D again. Even folks continuing to work with 1-2-3.

Memory Resident

That's because the idea of a memory resident spreadsheet makes sense, one that you can pop-up instantly while working in your word

way we dreamed a spreadsheet would function. Everyone who has seen it says things like, "Lucid 3-D is how software of the 1990's will look and perform", or even more to the point "This is the way I thought a computer should work". You'll see, Lucid is exciting.

way. Users say "It is so intuitive that I really don't need a manual." That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "If there ever was an interface idea so good it ought to be stolen and widely used, this is it."

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recog-



FIG. 2 Here we are, instantly. Notice the lower left corner showing we are on level 2. You can go down or up. (See next page)

processor or any other program. Lucid lets you cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Lucid 3-D was developed over the past two years with countless, exhaustive hours of planning and programming to produce something spectacular. This is a product that works the

multi-dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that. All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that

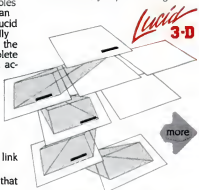


FIG. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (grey +).

What Makes It So Special

In the screen examples you can see Lucid is really

nize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.



Any cell can contain a complete other spreadsheet that you can access with a single key.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 400 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write



FIG. 4 Now instantly we are on level 3. By the way, each level is a different spreadsheet. Move to Dallas Morning News and press that button.

notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

Speed

Lucid 3-D is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D also lets you teach it any

combinations of keystrokes so that involved sequences can be

done with single keys. Plus more than just remembering keystrokes, Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menu work like Lucid where one choice can take you down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.



FIG. 3 We want more detail, so let's go to Newspapers. Just press the Grey + Key

“The best idea I've seen for a spreadsheet in years.”

Jim Seymour, Columnist, PC Magazine, PC Week



FIG. 5 Look! Level 4. You can work and make changes if you like. Now one button (grey -) takes you back instantly a level at a time. There's no limit on how big a model you can build.

Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

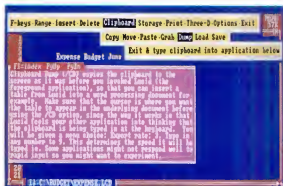


FIG. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid offers five audit displays and printouts

FIG. 7 Here it is right in Word Perfect for any word processor! Just like you typed it. You can go the other way just as easily.



work. The overall feel is tight and polished. In fact, Paul Somerson, executive editor of PC Magazine, used one word to describe it, "Slick".

PCSG has built a reputation as a development laboratory producing products that you know are excellent. In 1983 PCSG dominated the Model 100 laptop market with ROM based software that every reviewer rated as excellent. In 1985 we produced **LIGHTNING** the pioneer and award winning Disk speed up software. In 1986 we developed the **BREAKTHRU 286** accelerator board that blew everything else out of the water, and later we topped ourselves with the Breakthru 12. Now in 1987 those who have worked with Lucid 3-D tell us "you have done it again. This is software everyone should have."

Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D without having to upset your present systems.

We are excited about Lucid 3-D. But don't take our word for it. Take us up on our 60 day offer. Call us on our order line number and we will ship your order the very next day. This \$99 offer won't last because we will be shipping to the dealers soon. But in the mean time we invite you to try Lucid as part of our "Spread the News" campaign. Just pick up the phone and call us. We accept all major credit cards or you can order COD.

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The error correcting modem that ensures safe passage for your data—no matter where it's traveling.

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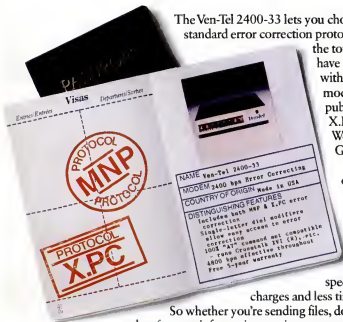
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CIRCLE 344 ON READER SERVICE CARD



LETTERS TO PC MAGAZINE



LAPTOP ADD-ONS

I enjoyed and appreciated your laptop section in the September 29 issue ("Laptop Add-ons for Desktop Power," *PC Magazine*, Volume 6 Number 16). Since I do virtually everything on a laptop and travel frequently, your coverage was right to the point in just about every respect.

Regarding the Toshiba T3100 laptop, is it safe to put this machine through an X-ray machine at airports? European security officers argue strongly and convincingly that it is perfectly safe, but a definitive answer would be valuable to me.

James M. Kearns
Rockville, Maryland

According to the computer support division at Toshiba, it is safe to put laptops through these X-ray machines, as the rays are not strong enough to erase any data on the disks. Incidentally, you can direct any of your Toshiba computer questions to its product support staff by calling (800) 433-5999.—Ed.

As a result of your evaluations and Editor's Choice selections, I have purchased several products, including a NEC MultiSpeed, a Logitech Serial Mouse, and *The Brooklyn Bridge*, to name a few. But after reading your articles on laptop add-ons ("Laptop Add-ons for Desktop Power"), I feel that you have abandoned me. Although I looked for information on the NEC MultiSpeed, all I saw was Toshiba, Toshiba, Toshiba. I know you have picked both the

NEC and the Toshiba as Editor's Choices, but can we please have more on the NEC?

I would like to thank you, however, for your mention of Touchbase Systems' Worldport 1200 minimodem ("Minimodem for Easy Riders," *PC Magazine*, Volume 6 Number 16). I have placed an order for it, and I'm sure it will be as good as you say it is.

Jay C. Vernon
Hightstown, New Jersey

Toshiba was the first company to unleash a serious laptop. That generated intense interest among users for productivity-enhancing accessories, which Toshiba and third-party vendors recognized. As other laptops gain popularity, the aftermarket will build accessories and PC Magazine will report on them. Of our 20 pages of coverage, only two stories were Toshiba-specific. One gave mixed reviews to Toshiba-built accessories; the other tested two add-in hard disks available for Toshiba machines and reported that versions would be available soon for the NEC MultiSpeed.—Bill Howard

FUTURE SHOCK

Jim Seymour was right: software does sell hardware! ("Software Sells Hardware," *PC Magazine*, Volume 6 Number 15). As an owner of an XT clone, I found that last year was bliss in the software-availability department—even the advent of the 286 and 386 machines didn't worry me as to the imminent obsolescence of my machine. But now, with the introduction of the PS/2, I hear hoofbeats behind me.

Although I realize software doesn't wear out, I now see a time when I'll be forced either to stay with an antique or to come up with the money for a more state-

of-the-art machine. I may not necessarily need the speed or power of the new machines, but I will need the newer software that just won't run on ancient DOS 3.x. As far as I'm concerned, when Alvin Toffler wrote *Future Shock*, he was predicting the personal computer market.

Bob Blumenfeld
St. Louis Park, Minnesota

EVERY NUMBER COUNTS

You are to be commended for attempting an extensive survey of the major accounting packages, an undeniably difficult task ("Making Every Number Count," *PC Magazine*, Volume 6 Number 15). Your article has initiated a lively and important discussion; let us hope that the complexity and scope of accounting packages will not deter you from continuing this discussion in the future.

I would like to point out that in the sidebar "Missing Links," you list six advanced features supposedly absent from current accounting programs. Our product, the *Platinum* series, offers every single one of those features today. Of course, we don't expect you to be able to cover everything in your reviews—our complete system has more than 250 .EXEs, making it a little tougher to scrutinize than your average pop-up calendar.

Kevin McGuirk
Advanced Business Microsystems Inc.
Irvine, California

In the sidebar "Missing Links" ("Making



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VIEWPOINTS

■ LETTERS

Every Number Count") G. William Dauphinais asks for accounting software designers to include a utility that will allow for partial transactions. His claim that "there is no reason why software should not include a special function that allows this kind of flexibility for all types of transactions" shows little understanding of the operations of small to medium-sized businesses.

The reason partial transactions should never be accommodated is that in real life, most of those transactions would never be completed on a timely basis. Can you imagine what would happen to a firm's books if the bookkeeper left some entries partial or forgot into which accounts they should have been entered? Disastrous!

A far better solution—and one that Mr. Dauphinais points out—would be to provide a pop-up utility of account numbers. That would be something!

Kevin Collins
Naugatuck, Connecticut

After reading your review of *RealWorld 4-in-1 Basic Accounting* ("Making Every Number Count"), my faith was shaken. Rex M. Vincent was wrong in stating that the program "posts all transactions as you input them." *RealWorld 4-in-1* does batch updates: every section of the program that updates a file allows you to print a transaction edit list, after which you may make changes prior to posting.

D. Delsi Lints
Alameda, California

Yes, you can edit transactions up to the time of posting. As stated in the article, however, the transactions must be in balance before the program will post them—all transactions that have been inputted will be posted.—Ed.

Thank you for your comprehensive review of accounting packages ("Making Every Number Count"). Although I agree with your evaluation of Great American Software's *One-Write Plus*, I would like to note that the company has reneged on its written promise of lifetime toll-free telephone support. Now we are told to pay for the call. What's next, loss of free support? When I spoke with Great American's supervisor to protest this breaking of its

word, I was told to complain to my lawyer. What are we to do?

Barry S. Reder
Oceanside, California

According to Great American Software, the company has eliminated the toll-free number in order to hire more technical-support people.—Ed.

DON'T IGNORE OPTION

Congratulations on the penetrating insight and accurate analysis you showed in selecting *Newkey* as an Editor's Choice ("RAM-Resident Macros for the Virtuoso Keyboard," *PC Magazine*, Volume 6 Number 16). Needless to say, we at FAB Software wholeheartedly agree with your choice!

Nevertheless, we would like to point out that the cited problem of *Newkey's* being unable to call up the built-in diagnostic utilities in a PC's Limited AT by pressing Ctrl-Alt-Enter can be resolved: just use the Ignore Key option on the main menu of *Newkeysp* (the support program) to cause *Newkey* to ignore Alt-Enter.

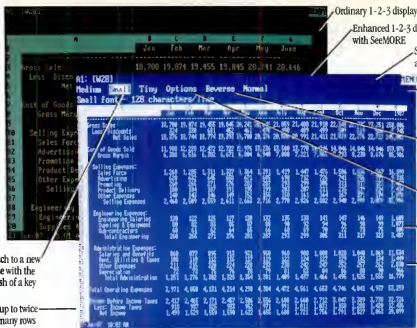
The problem arises because *Newkey* gives meanings to some of the keystrokes that are normally ignored, and when it does this, it doesn't give the other interrupt handlers a chance to act on the keystroke. The Ignore Key option will tell *Newkey* to ignore Alt-Enter and pass the keystroke on to the other interrupt handlers. I also use the Ignore Key option to ignore Alt/ and Ctrl/, so that Alt-Ctrl/ will toggle the speed between 6 MHz and 8 MHz on a PC's Limited AT.

Frank A. Bell
President, FAB Software
Wayland, Massachusetts

THE MAC SOLUTION

In your September 29 issue, John C. Dvorak states that all PC software should have a money-back guarantee, calling it the only solution to memory-resident roulette and hardware conflicts ("It Works, or Else!", *PC Magazine*, Volume 6 Number 16). Mr. Dvorak is obviously myopic. The only real solution seems to be to drop IBM and get a Macintosh.

I've been a diehard IBM user since 1982, but looking over into Macintosh land is enough to make me drool. When



Switch to a new size with the push of a key

See up to twice as many rows

Choose mixed font format (Top 3 lines big)

Choose normal or reverse video

Change colors

Print any compressed screen

No special hardware required

Unretouched photo of EGA display

1-2-3 never looked so good.

Introducing SeeMORE™, a powerful screen manager for 1-2-3® that expands your worksheet view with the push of a key. SeeMORE gives you a choice of compressed formats that double, triple or quadruple the number of cells displayed on the screen.

Install the SeeMORE program with 1-2-3 and you can build a twelve month forecast without stopping to scroll around. All twelve months appear on the screen. SeeMORE lets you see the big picture.

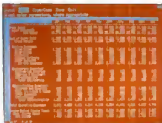


Switch to reverse video.

No special hardware is required to run SeeMORE. All you need is a CGA, EGA, VGA, Hercules or compatible graphics adapter.

SeeMORE manages the screen without interfering with the normal operation of 1-2-3. You can zoom in and out as you

build and manipulate a worksheet – you don't need to exit 1-2-3 and switch to a new driver set! And SeeMORE lets you produce hardcopy printouts of any compressed screen with the push of a key.



Change background and foreground colors.

Get SeeMORE and expand your horizons. Works with 1-2-3 Rel 2 on the IBM PC, XT, AT, PS/2 and compatibles. \$79.95. No copy protected. Symphony version coming soon.

	CGA	EGA/VGA	Hercules
Normal	80 x 25	80 x 25	80 x 25
SeeMORE:			
• Medium	91 x 28	106 x 43	120 x 43
• Small	106 x 33	128 x 43	144 x 43
• Tiny	128 x 33	160 x 58	180 x 58

SeeMORE is another fine product from Personics, maker of the award-winning SmartNotes™ program.

SeeMORE™ for 1-2-3

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dStatements	Accounts Receivable	\$100	*
dPayables	Accounts Payable	\$395	\$595
dOrders	Sales Order Processing	\$295	\$495
dPurchase	Purchase Order Processing	\$295	\$495
dPayroll	Payroll/Labor Accounting	\$395	\$595
dAssets	Fixed Assets Management	\$395	\$595
dProject	Job Cost Accounting	\$395	\$595
dMaterials	Manufacturing Planning	\$395	\$595
dProfessional	Time/Billing	\$395	\$595
dProperty	Property Management	\$395	\$595
dMaintenance	Service/Equipment Maintenance	\$395	\$595
dMenu/Backup	Main Menu/File Backup	\$ 65	\$ 65

*Compiled versions are \$45-\$295.

*MultiNet dInvoice and dStatements are combined

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CIRCLE 470 ON READER SERVICE CARD

■ LETTERS

you buy a Mac you get the complete system. You get hi-res screens, multiple screens, unbelievable new software—and it all works together. And "memory-resident" is not an issue.

But the kicker is that Macs will have real multitasking long before PCs, and it will be bundled with the system. Over in IBM land there is total anarchy. A good operating system could take control of the chaos Mr. Dvorak describes, but we'll all be dead before the people working on OS/2 get their act together. IBM is sending some pretty clear signals right now, and I bet the smart-money people will start to run like hell—straight to Apple!

Marshall Brain
Zebulon, North Carolina

KBX IS EVEN BETTER

The utility program KBX.COM by Jeff Prosis is even better than its author claims (PC Lab Notes, *PC Magazine*, Volume 6 Number 16). For example, it is fully compatible with the *SideKick* notepad editor, although the high-bit characters do not appear as such on-screen unless the Graph display option is selected with the 'Q' G toggle.

Also, while Mr. Prosis's comments about incompatibility with *WordStar* are valid for version 3.x of that program, KBX works properly with *WordStar* 4.0. The new *WordStar* assigns block graphic characters to the Alt-function keys and allows all 8-bit characters to be entered via the Alt-numeric keypad method. KBX not only facilitates the input of high-bit characters but, in the process, frees up the Alt-function keys for other uses in *WordStar*.

E. Michael Perdue
Norcross, Georgia

WRITER WAS RIGHT

I find it interesting when readers write in to say that one of *PC Magazine's* writers is wrong. For example, in the July 21 issue (Letters to *PC Magazine*, Volume 6 Number 13), a reader named Stephen H. Leech stated that in DOS 3.x you can put two spaces after an ECHO command to print a blank line. Ethan Winer said otherwise.

Well, I just had to try this out and see for myself. It seemed so simple; how could I mess up? Guess what? Ethan Winer was correct. Like I always thought, your writ-

ers do their homework before they start writing.

One final note: I use DOS 3.20 and have found that if you put a colon after the ECHO command you will also get a blank line (really, try it). This is useful for users who for some reason can't put a CHR\$(255) after an ECHO statement.

Michael Tighe
Freehold, New Jersey

ANOTHER LOOK AT DVORAK

Sometime ago I used to feel the way many of your readers feel toward John C. Dvorak and had a hard time getting through his column. But then I made an assumption and realized that Mr. Dvorak has developed a style and often writes with tongue in cheek. I also realized that Mr. Dvorak is not always right. Consequently, I have come to enjoy his column very much—after all, he does write it for my enjoyment. I suggest all your readers who have bad things to say about Mr. Dvorak take a full look at him, his picture with the sly smile, and his column.

Marshall W. Hughes
Ocean Ridge, Florida

CORRECTIONS/AMPLIFICATIONS

Unison Technology's *Predict!* is not copy protected and is compatible with more than 70 printers, plotters, and display controllers ("Searching for Solutions," *PC Magazine*, Volume 6 Number 15).

The correct phone number for Quarterdeck Office Systems (First Looks, *PC Magazine*, Volume 6 Number 15, page 38) is (213) 392-9701.

HOW TO WRITE TO PC MAGAZINE

Do you have a comment, compliment, or criticism about something you've read in *PC Magazine*? A question you'd like to open up to other readers? Then send your opinion to Letters to *PC Magazine*, One Park Avenue, New York, NY 10016, or through MCI mail to PCMAGAZINE.

All letters become the property of *PC Magazine* and are subject to editing. We cannot publish letters that do not include a name, address, and phone number for verification. We're sorry we're not able to answer letters personally.

What's New in Shareware...

Big-Cal creates a file containing a month's calendar for printing on one page (horizontally or vertically) or spread over two pages (which you tape together).

Big blocks for each day allow plenty of room for making plans. Small calendars for the preceding, current and following months are added for reference.

The file can be sent directly to the printer, or you can use your favorite word processor or editor to add any custom touches which your printer supports, such as wide or emphasized print, italics, etc.

EDraw 3.2 is a general purpose drawing program for engineers, teachers and students. It is ideal for schematics, block diagrams and flowcharts.

3x3 prints labels for 3.5" disks showing file names, disk name, size and free space and comments.

Library for Turbo-C has over 100 functions for use with Borland's Turbo-C (tm).

MyEd is a pop-up text editor that takes as little as 7k of RAM, yet has many features, such as optional wordwrap, paragraph reformat, auto-indent, unlimited file size, split/join lines, block copy & delete, and source code too.

NamePal is a name, address and phone number recording program that prints mailing labels, pocket-size address books, rolodex cards, 3x5 cards and full-page rosters.

Ticklex is an appointment scheduler and reminder program. *Reminders* warn you at preset times before an appointment.

Vehicle Maint./Exp. tells you when it's time for your car's regularly scheduled maintenance and even prints a checklist and keeps track of your auto expenses.

These programs are shareware, meaning that you can try them for our disk fee of \$5/disk and pay the author only if you decide to keep using the program. Registration fees range from \$5-\$40.

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10 BIG REASONS IT'S TIME YOU CHANGED YOUR EDITOR TO BRIEF

1 FUNDAMENTAL TRUTH. If you are a programmer, you use your editor more than any other tool. If it isn't the best, the fastest, the most versatile, the most productive...well, then neither are you!

2 OUR ENTHUSIASM. While we do not publish BRIEF we wish we did. We sell so many BRIEFs that we've been advertising it non-stop since it was introduced two years ago. We're not alone in our enthusiasm. There is no end of accolades from other admirers:

BRIEF Encounters

"The word is getting around—that BRIEF is simply the best text editor you can buy."
John Dvorak in *InfoWorld*

"In the last five years, only a handful of applications have altered the way we use microcomputers. The writers' impact on astounding BRIEF is a 'writer' that will most definitely change the way we develop applications." *Data Based Advisor*

"Overall, BRIEF is an excellent and efficient editor with capabilities that are truly useful. If you are a serious programmer or developer of commercial applications, the BRIEF/dBRIEF package is one of the best investments you can make." *PC Magazine*, 7/86

"Every time I've mentioned text editors I've got a raft of mail urging me to try Brief. Now that I've tried it I see why it has windows—boy, does it ever have windows! it will do just about anything you want it to. Look no further, recommended." *Jerry Pournelle, Byte* 12/86

Best editor of 10 compared
Dr. Dobbs Software Tools

3 WINDOWS ON THE WORLD. Why the excitement? First, BRIEF's architecture. Any number of files of virtually any length can be open. (Start BRIEF with ".*" to prove it.) Open as many tiled windows as fit the screen—over/under and side-by-side—to work on any of your files. Open, close, and resize windows as you go. In each window, full screen or tiny, all editing techniques are at hand—high-speed cursing, paging up and down, horizontal scrolling, optional word wrap. Load the same file in any number of windows to view different areas simultaneously. A change in one changes all. Cut and paste text blocks between windows and files, or into buffers for later recall. All files stay in memory, so you can always go back to snip some more.

4 WHOLLY MACROS. Much of BRIEF was written in its own macro language. It is that powerful! The language and its compiler come with every copy, as do many standard macros, with source code for learning by example. It is a complete language with conditionals, loops, recursion, global and local variables, even data types. It can control files, windows, and the keyboard. It has structure, 32-character variable names, and—not at all like 1-2-3's cuneiform—is entirely readable, like a hybrid of LISP and C. With it you can develop a library of routines to power BRIEF your way.



5 UNDO. NOT UN-DELETE. Don't confuse the two. BRIEF doesn't just keep snapshots of recent deletions should you want to pick them up from the cutting room floor. It can reel the whole film back—undoing any command that affected the cursor or the text. Watch it undo a global replace, for example. Unconsoy I can back up 300 times, all the way to the beginning of a session. "Works like a dream," said *The C Journal*.

6 SHELL GAMES. Leave BRIEF, run your compiler, print out the error messages, load up BRIEF again? No way! Run your compiler from inside BRIEF*! It will point to each error line in your source program, still loaded in memory, for immediate editing. You don't have to leave BRIEF to use DOS either. BRIEF disappears from the screen to get out of your way, but say bye to DOS and BRIEF pops back to the screen, as do all the files you were working on.

7 KEY WHIZ. You can reassign BRIEF's command keys to whatever keys you're used to, even your old editor's, so you don't have to seed your fingers back to school. Macro execution can be assigned to single keys. Or you can tell BRIEF to listen while you tap out a complex routine. It will save and playback faithfully, a shortcut macro without a single line of coding.

8 MULTI-LINGUAL. BRIEF's macro language is perfect for writing formatters for your language which indent, match up parentheses and brackets, and set up statement templates for fill-in. BRIEF comes with C language support already built in. Others have written macros to format Pascal, BASIC, LISP, Prolog, FORTRAN.

9 QUICKER PICKER-UPPER. Looking for something? BRIEF has full UNIX*-like expression search tools to forage and find and fix any file in memory. Literal strings with wildcards and "?" character masking, sure. But also indifference to case or intervening characters, [aeou] to match all vowels, or [-aeou] to match anything but vowels, [a-f,m] to match character ranges, beginning or end of line searches, even multiple choice pattern matching and replacement.

10 REASONS 11 THROUGH 20: 11. BRIEF comes with a color option. You can select your own color scheme anytime. 12. It supports EGA's 43-line

dBRIEF. The Power Environment for dBASE Programming

Many worthy utility products supply needs that dBASE's programming language doesn't—dUTIL™, dFLOW™ and a host of others. Trouble is, you have to use them separately. They combine their output into your dBASE program files.

No longer dBRIEF™, written in BRIEF's macro language, grabs hold of BRIEF and turns it into a complete dBASE III and III Plus programming domain. Using BRIEF's underlying shell capabilities and its own interfaces, dBRIEF can run external utility libraries, plus dBASE itself, and link to the Clipper™, Foxbase™ and Quackrel™ compilers, all with dBRIEF still loaded and running the show. It can do what BRIEF already does plus:

- Convert a screen layout into dBASE code for interactive data entry
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- Indent automatically for clear display
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mode and can display up to 128 lines long. 13. Full 8-bit ASCII display; the whole character set can show on screen. 14. Full path support. 15. Command line start-up flags to modify BRIEF's behavior, change a path name, or run a macro: for example "wp" which turns BRIEF into a word processor with wraparound and margin setting. 16. Automatic file save during idle moments. 17. Compatibility with most stay-at-home programs (like Siskel™), multi-tasks (like Microsoft Windows™), and networks. 18. A bulletin board with public domain macros contributed by a mushrooming cult of macro-mancers. 19. No copy protection. 20. Context sensitive help, and phone support from the publisher.

* Brief needs 192k normally, 320k for complete feature. *Product must be returned in resalable condition.

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Communicate from within your own C program. Over 120 functions and demo programs in C and assembler source to set up interrupt-driven communications for up to 16 channels. Up to 9600 baud, ASCII or binary, any parity or word length, 8550 UARTs, Xmodem and Xmodem, Modem software. Goodbye separate communications software. Specify compiler.

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For a trifling price, BASTOC™ moves thousands of BASIC code out of C. It's a translator which takes in Microsoft Extended BASIC and emits pure K&R C for Micro- or Macro-Assembler. Converts unmodified BASIC code. Optimized to dramatically reduce execution time. Dynamic string allocation ends BASIC's catastrophic heap for garbage collection. Heavy macros! Let \$495, US \$395

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SUPER SOURCE
Aldebaran's Source Print

Author Al Simpson writes "the best overall debugging technique is to draw lines to connect all the IF and DO WHILEs etc with their ENDFITs and ENDDOs. Then use a pencil to '—Well, thanks, Alan, but we'll use Source Print instead. It draws those vertical lines to connect the beginnings and endings of structure in a vivid display of your program's organization. It can print your programs with page numbers, headings, line numbers, and so on. It can also print a table of contents and cross-reference index." Occasionally a utility comes along that makes a programmer's life much easier. Source Print is such a program," says PC Magazine. List \$75, Ours: \$60.

...add Tree Diagrammer

Tree Diagrammer prints an organization chart of your program's structure showing the hierarchy of function, procedure and subroutine calls. Shows at a glance what routines call each other for clearer debugging. Every shop should have this important documentation tool. List: \$35. Ours: \$45.

C-TREE & R-TREE

c-tree: The only major b-tree file manager with network support in the standard low cost version. c-tree™ gives you record-locking routines for DOS 3.1/3.2, UNIX and XENIX, and it even comes in C source code, yet there are no royalties. Source sticks to K&R, so C-tree is portable. Tests in many environments prove it.

Permits any number of keys for a data file—alpha, numeric, even floating point. Handles files with varied record lengths, multiple keys in one index file. Both high level and decomposed functions. It's the works.

r-tree: Adds the ability to produce ad hoc reports from files maintained by ctree (v 4.1 and up). Link a file description to the r-treeTM library, and use any text editor to write report scripts with no further Coding. Reports can score data in several files, select on criteria, join findings into new logical recotids, sort them, calculate new fields and columns, tabulate by control breaks. Comes in source, same portability as c-tree, and fits any compiler.

	Last	Current
C-tree	\$305	\$329
F-tree	\$295	\$249

WINDOWS for DATA

MS-Soft Windows Compatible

Only one package can be easily recommended" said Computer Language (June 1987) reviewing the window and data entry products for C. Complete field level functions specify prompt string, field length, data type, screen location, picture, target variable, entry rules, help messages, even functions to call for validation once data keyed in.

Windows for C is a subset. No data entry but all windowing functions. Unlimited windows can be made either to pop up or permanently overwrite the screen, scroll and highlight lists vertically and horizontally. Specify Compiler. Windows for Data. List \$295, Own \$250, Windows for C. List \$185, Own \$140.

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400 Functions, 30¢ Each

You've probably seen the speed and power of Essential's C function library without knowing it. Software greets have been using it for some time to give today's top products power and panache.

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	List	PC Base
C Utility Library	\$185	\$118
Essential Graphics	\$250	\$183
Essential Constructions with Breakout Debugger	\$185	\$125

Shopping List for the Power Workbench

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PC BRAND: YOUR SOURCE FOR dBASE ENHANCEMENT TOOLS

QUICKCODE PLUS FOR dBASE

Industrial Strength dBASE Application Generator

Writing code takes time and time is money. QUICKCODE PLUS saves you both, with dozens of features you've never seen before in a dBASE code generator.

Consider the value of automatically generating the following code, bug-free, in just minutes: Relational applications that read, display, and update a dozen or more databases simultaneously; "Real-time" calculators, performed on screen as the user enters each field. Forms up to 11 screens long, with the ability to pass data between screens. Computational formulas that automatically combine data from different databases. 9 Data types, 16 field types.

Generic LOOKUP and UPDATE functions are provided on the disk as dBASE source code, which you can add to your own dBASE library. All generated code is highly optimized, modular, commented, 100% compatible with Clipper and Foxbase+, and conforms to the programming standards recommended by experts like Tom Rittig and Adam Green. User manual includes extensive documentation of the generated code and instructions on how to permanently embed your own changes in the generated code. Truly the King of code generators.



structures on how to permanently embed your own changes in the generated code. Truly the King of code generators.

	Last	PC Brand
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QUICKREPORT	\$295	\$170
QUICKENTRY	Call	Call

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Compile dBASE for Speed, Protection

Clipper™ turns lumbering dBASE® into a speedy dMCON with benefits bobbing in its wake. Your source code is submersed from public view; you can distribute your compiled application without compile, and your customers don't even need copies of dBASE! The Spring '87 Clipper offers index files compatible with dBASE III Plus, and networking capabilities to run compiled programs on major networks supporting DOS 3.1 with no restrictions on number of users. Clipper offers arrays, menu-building commands, user-defined functions, control-sensitive help techniques for applications, a debugger, and a supports Expedited Memory. It goes well beyond dBASE, with

easy-to-use menu-driven ASSIST mode using the Mac interface; an interactive command mode like dBASE at the dot prompt; and an application programming language fully compatible with dBase III. It gives you the power to create dBASE language applications on the Macintosh and transfer back and forth to the IBM® world. McMain accelerates up to 16 million records, 32,000 characters per record, 256 characters per field, and up to 32 files open concurrently. No copy protection. Last \$295 PC Brand. Call.

dBC

Identical dBASE III Plus Files Using C

dBC™ is a series of C libraries from Lettice which creates, accesses and updates files identical to those of dBASE itself. So dBASE can read and update the files too.

What isn't means both C and dBASE applications can operate on the same data bases interchangeably. It means C programmers can interface with the big market of dBASE users out there, yet side-step the dBASE language. It means dBASE applications can now be linked to the universe of C libraries and tools to add windows, graphics, statistical analysis, all the things dBASE cannot do. It means the speed and power of C to unperturb clients accustomed to dBASE. dBC's functions parallel all dBASE's file handling commands, many decomposed to permit direct data manipulation. Ten each of data, index, and memo files may be opened at once. It is a complete IBM package that you can forget dBASE and use dBC only for C programming.

Our version of dBC meets file formats for dBASE II and III and now dBASE III Plus makes your programs network ready!—any station as a network allows hand-off mode handles record and file locking and unlocking automatically. Close in functions give you direct lock/unlock control.

Supports all four memory models. Specify compiler and dBASE version. For dBASE III, Last \$250. Call \$195. For dBASE III Plus, Last \$750. Call \$595. Play double and you get source code.

WALLSOFT'S THE UI PROGRAMMER

Code generator for dBASE

The UI Programmer was developed for professional dBASE programmers who have been frustrated in the past by code generators. Up until now, a serious dBASE programmer had to take what ever code a generator produced and modify it to their needs. With UI, the developer can generate exactly the dBase code wanted.

UI (User Interface) has two main functions: the first is a powerful form-editor to create sophisticated screen and menu forms in a matter of minutes. The editor is completely menu-driven. It works on the "point-and-shoot" principle—just put the cursor where you want and tell UI what to put there.

UI's other, more important, main function is generating code for the forms

you've designed. Once you have a form the way you want it, you call up the "Generate" menu and tell UI which template you want to generate the code with. That's the key—each template tells UI to produce a different kind of dBASE program.

It's through these templates that you can program the way UI generates source code. You can use the templates that come with UI, but there are about 25 of them, completely rewrite them, or write your own. So you don't lose control of design, like you do with other generators. You just let UI do the tedious work.

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drive will run even faster on your RAM disk because Overdrive eliminates the DOS "thinking time", not the disk time. Overdrive hides itself into DOS and replaces its add slow program code with extremely efficient, well-designed routines.

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■ MITT JONES

PC ADVISOR

Help in toggling between applications, in choosing the right print spooler, in finding products for the PCjr, and in mastering the Dvorak keyboard.

**PRINT SPOOLER**

I am looking for a print spooler that will spool to extended memory or to a RAM-disk. Any suggestions?

Lonnie A. Raffray
Victorville, California

Both PrintQ and Duet will print to a RAM-disk and will give you a host of other features in the bargain. Unlike the simple print spoolers some manufacturers include with their products to add value, these two packages give you an impressive range of control over your output and let you store your print queue on disk, including a RAMdisk in extended memory, instead of hogging valuable lower RAM.

Both PrintQ (\$89; Software Directions, Rondolph, N.J.; (201) 584-8466) and Duet (\$89.95; Consumers Software Inc., Santo Cruz, Calif.; (408) 426-7311) let you change the priority of print jobs, cancel a print job or restart at a specific page, print multiple copies, and set your equipment to print immediately or delay until a later time.

Duet adds a few features that let you enhance your output before it prints. For example, the printer control menu lets you change margins, fonts, and other details on the fly. Duet also includes several features that cater to 1-2-3 users. You can print part or all of a spreadsheet, upright or sideways, without loading the file into 1-2-3.

PRODUCTS FOR PEANUTS

I've been looking for a 1-2-3 cartridge for my PCjr for some time now. The cartridge

has been discontinued, and calls to IBM, Lotus, and several retailers have proved fruitless. Has anyone picked up the PCjr aftermarket? Where can I get hold of PCjr products?

Rod Stewart
Hillsdale, Michigan

Several manufacturers and retailers have picked up the PCjr aftermarket. Computer Reset (Garland, Tex.; (214) 276-8072), The Peanut Gallery (Troy, Mich.; (313) 585-6897), and PC Enterprises (Belmar, N.J.; (201) 280-0025) all stock the 1-2-3 cartridges. Computer Reset sells the cartridge for \$125 and reports only a few left. The Peanut Gallery sells the cartridge for \$299 and also reports very few in stock. PC Enterprises seems to have the best supply of 1-2-3 cartridges, priced at \$249.

For information on other products, you've got several alternatives. Computer Service's IBM Junior Forum arguably rates

as the best source of information. Aside from being able to trade tips with other PCjr users, you'll have access to an up-to-date list of third-party equipment suppliers and manufacturers.

In addition to offering a nice range of PCjr products through its mail-order catalog, The Peanut Gallery invites anyone to call for PCjr technical support, and operates a BBS at (313) 585-3893, at no cost to users.

PC Enterprises caters to PCjr owners with a wide range of products that it designs and manufactures. Other products, such as the 1-2-3 cartridge and unused IBM PCjr systems and peripherals, constitute a small portion of its offerings.

SHUFFLING APPLICATIONS

I'm searching for a way to switch back and forth between programs without going through all the time-consuming steps normally required. I've looked at Windows and DESQview, but a multitasking environment is more than I want or need. I use an AT&T 6300 with a hard disk and 640K bytes of RAM.

Jerry Smoot
Fountain Valley, California

Software Carousel (SoftLog Solutions Inc., Manchester, N.H.; (603) 644-5555) offers what you need. I've recommended the package for other uses as well, but Carousel's real purpose in life is to make switching between programs a breeze.

Carousel centers around ten partitions, each of which functions as a separate operating environment and holds one or

■ Unlike the simple print spoolers some manufacturers include with their products, *PrintQ* and *Duet* give you impressive control over your output.

■ PC ADVISOR

more programs. Once you've loaded your programs into the partitions, either manually or via a special batch file, you can toggle between partitions without losing your place in their respective applications.

The catch is that you've got to provide enough memory for Carousel to load all the applications you wish to use. When you switch to a new partition, Carousel moves that application into lower memory. But Carousel must also have room to store your other applications—either in extended or expanded memory or on your hard disk.

If you don't mind waiting several seconds each time you change partitions, you'll do fine using your hard disk for storage. For an ideal combination, however, invest in an expanded memory board. Intel's Above Board/PC (Intel Corp., Hillsboro, Ore.; (800) 538-3373), the acknowledged standard, is always a safe choice and will work in nearly all compati-

■ Carousel is a good choice for utilizing the AT's 384K bytes of extended memory.

bles, including your AT&T 6300. The Above Board lists for \$345 with 64K bytes of RAM. You can configure the board with up to 2 megabytes of memory. The Above Board lists at \$995 fully loaded.

Carousel is also a good choice for utilizing the AT's 384K bytes of extended memory. Unlike currently available multitasking environments, which require enormous amounts of RAM to be truly useful and which can crash your system when

you get too ambitious, Carousel is extremely well behaved and proves useful even if you're forced to employ your hard disk for program swapping.

TYPING, DVORAK-STYLE

I read with interest your recent advice on typing tutorial packages. Do you know of any tutorial packages that teach Dvorak-style typing?

Bradley D. Lutz
Tampa, Florida

Typing Tutor IV (\$49.95; Simon & Schuster Software, New York, N.Y.; (800) 624-0023) will work. To get lessons tailored to the Dvorak layout, you simply type TTD instead of TT when you enter the program.

ASK THE ADVISOR

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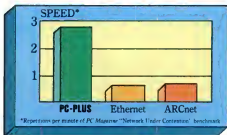
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FIRST LOOKS

SPREADSHEET WAR RAGES ON

Quattro: More than 1-2-3 At Less than Half the Cost

PC HANDS ON

BY MIKE FALKNER

It's finally here. Borland International has released *Quattro*, the "Turbo 1-2-3" of its ever-growing product line, after 3 years of development. Although a latecomer to the spreadsheet wars, *Quattro* is one of the few products to provide full Release 2.01 compatibility in both menu structure and macro language.

To install *Quattro*, you simply copy three floppy disks onto your hard disk drive. After you type a Q to start the program, *Quattro* checks your system for

	1st	2nd	3rd	4th	5th
Business					
Southeast	20	10	40	\$20	
Northwest	30	40	60	\$60	
West	30	25	40	60	
Midwest	40	60	90	\$90	
Total	120	145	230	300	675
Product Cost					
Books	1	2.5	2.2	3	2
Books	1	2.5	2.3	2	2
Mag	0.1	0.5	0.5	0.5	1
Assembly	0.1	0.5	0.4	0.1	0.5
Total Cost	2.2	5.0	5.4	5.7	3.5
Other Costs	40	87	130	200	205
Total Costs	42.2	92.0	145.4	235.7	298.5
Total Profit	77.8	52.2	84.6	164.3	104.5

Quattro's menu builder lets you customize your menus without macros to match your application; the default menu is a 1-2-3 work-alike.

screen adapters, memory boards, and coprocessors to automatically configure your system—in sharp contrast to the multistep installation required by 1-2-3 and Microsoft Excel.

You can select your graphics printer from within the Graph menu options, and you control your text printer's capabilities with setup strings.

Quattro uses the familiar 1-2-3 row-and-column screen format, and formulas are displayed on the top line of the screen. For formulas that are longer than 80 characters, *Quattro* wraps them around to the next line so that the entire for-

(continues on page 34)

QB 4.0 Compiles as You Work, Understands Other Languages

PC HANDS ON

BY ETHAN WINER

With QuickBASIC 4.0, Microsoft Corp. has added a wealth of important new features to the BASIC language. Highlights include new commands, an enhanced debugger, unlimited array size, and support for both Hercules and VGA graphics modes.

QuickBASIC 4.0 also comes with greatly expanded documentation, including tuto-

rials, examples, and several complete applications. But that's just the beginning.

A Complete Rewrite

Unlike earlier versions of QB that have gradually evolved from the original BASCOM compiler, Microsoft's latest release has been rewritten almost from scratch. The centerpiece of QB 4.0 is a brand-new editing environment and incremental compiler. Where most language compilers process an entire program at one time, QB

4.0 compiles each program line as it is entered. Thus you avoid the long wait normally required each time a small change is made to the source code. And if you make a mistake in typing or enter a syntax error, you get an immediate error message.

QuickBASIC 4.0 can handle long (32-bit) integers, dealing another blow to those who denigrate BASIC as a less-than-serious language. Support for IEEE-format numbers is also included. And you have access to

(continues on page 34)

HANDS-ON INDEX

AWESOME I/O CARD

Sign of boards to come? ... **36**

DOUBLE PLAY

A hand-me-down solution for the PS/2 Model 50's slow hard disk drive ... **38**

BITSTREAM'S FONTWARE INSTALLATION KIT

How to obtain better-looking fonts ... **43**

QUICK LOOKS

Instant Yellow Page Service, The Soft Font Manager, Funk and Wagnall's Standard Desk Dictionary ... **46**

D.A.V.E.

Data verification for 1-2-3 databases ... **48**

FACT
FILE**QuickBASIC 4.0**

Microsoft Corp.
16011 NE 36th Way
Box 97017
Redmond, WA 98073-9717
(800) 426-9400
(206) 882-8080

List Price: \$99; upgrade from Version 3.0, \$25; upgrade from Version 2.0, \$35.

Requires: 256K RAM, one disk drive, DOS 2.0 or later.

In Short: A complete rewrite and redesign of the most popular PC programming language. Not copy protected.

CIRCLE 441 ON READER SERVICE CARD

lar and about changes to the editor, but the arsenal of new commands makes the trade-off well worth while.

from the spreadsheet, and you can choose from ten graph types, including 3-D bar, area graphs, and points-only. You can assign a different graph type to each of the six sets of data points. *Quattro* supports printers from 15 major manufacturers, including laser printers from Apple and Hewlett-Packard, and you can output graphs to a 1-2-3 .PIC format.

Aside from 1-2-3 compatibility, *Quattro* has added some impressive capabilities. It can read and write files formatted in *Paradox*; *dBASE III*; *Reflex*; *Symphony*; 1-2-3, Release 1A; 1-2-3, Release 2.01; and its own format (.WKQ). *Transcript*, a 10K-byte add-in that comes with *Quattro*, saves your keystrokes to disk and lets you undo the last command or play a string of commands back, up to a point. You also have total control over display colors, and screen refreshes are quick, especially on the older CGA screens.

Quattro's documentation includes three very complete and well-indexed manuals. The *Quattro User's Guide* goes into great detail about how to use the package. The *Quattro Reference Guide* is useful for quick references once you know the package.

Quattro was well thought out, but there are still a few problems with it. In our tests, *Quattro* sensed the CGA card in one PC but it displayed color on its amber screen, making it hard to read until the defaults were set to monochrome. Borland did very little to enhance 1-2-3 database capabilities, a sore spot with many users. The *Quattro* menus are well done, but at times they don't go where you expect them to go.

Quattro is an impressive product at an affordable price.

In the Works: Micro Channel Designs From Two Leading Chip Manufacturers



PREVIEW

BY JONATHAN MATZKIN

When IBM unveiled the Micro Channel bus, there were predictions about the impossibility of cloning the new architecture. But two preeminent makers of logic chips are sowing the seeds of Micro Channel-based systems.

Western Digital announced core logic, disk interface, graphics, and I/O chips that could be used, in conjunction with a PS/2-compatible BIOS, to clone the PS/2 Models 50 and 60. These 80286 support chips could sustain clock-timing cycles of up to 20 MHz.

Chips and Technologies is also at work on chip sets that would open the market to clones of the PS/2 Models 50 and 60. The chips should be ready by year's end.

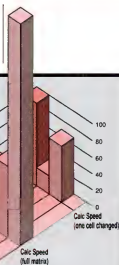
Since these chips are expected to ship in the first half of 1988, PCs with Micro Channel

architectures are not likely to be manufactured before the second half of next year.

But new chips are aimed at more than cloning the Micro Channel. A recently announced interface from Chips and Technologies could allow add-in manufacturers to adapt their current boards to the Micro Channel architecture with a minimum of redevelopment. The interface chip would be integrated into the redesigned boards, and would generate the signals needed by the Micro Channel architecture.

Such a development would probably speed the acceptance of the Micro Channel as a new standard. Easier portability of hardware from the old to the new bus would result in a rapidly widening selection of options for the Micro Channel user. Manufacturers will be able to provide Micro Channel compatible boards faster if it is not necessary to redesign the hardware completely.

With more features than 1-2-3, menu and macro compatibility, and better graphs, *Quattro* makes it awfully hard to justify buying 1-2-3, Release 2.01, instead.



Performance Tests: *Quattro* vs. 1-2-3 and Microsoft Excel

Quattro is not especially fast in calculations on large spreadsheets, compared with the top spreadsheet speed demons. But *Quattro*'s intelligent recalc provides major time savings when just one cell changes in a large spreadsheet.

Performance Times (Times given in seconds)

	Calc Speed (full matrix)	Calc Speed (one cell changed)
1-2-3, Release 2.01	70.1	70.1
1-2-3, Release 2.01, with Speedup	55.0	16.0
Microsoft Excel	48.0	48.0
Quattro	129.0	0.1

The Calc Speed test spreadsheet contains 2,030 cells between A1 and Z80 with labels and with formulas that do four-function math and square roots.

We ran the test two ways: changing a value that affects the full matrix, and changing a value that affects no other cell relationships.

A Taste of Things to Come: \$844 Awesome I/O Board Boosts Hard Disk Transfer Rates

PC HANDS ON

BY WINN L. ROSCH

While PC performance has raced forward by a factor of 20 in the last half dozen years, hard disks have lagged far behind, held back by, of all things, the PCs themselves. The Awesome I/O Card, an \$844 board from CSSL, promises to change all that by bringing mainframe technology to your desktop mass-storage system.

The Awesome I/O Card is a hard product to describe. Perhaps the best place to begin is with what it's not. It is *not* a hard disk controller. Rather, the Awesome is a controller for your existing hard disk controller that can enhance the performance of your overall hard disk system.

As such, the Awesome is a clever combination of hardware and software. Its hard heart is a microprocessor and a large dose of memory, up to 512K bytes of CMOS static RAM that's kept fresh for more than 2 years by an on-board battery. The memory is used to make a disk-caching system that does not intrude on main memory.

Because it's nonvolatile, the cache can buffer writes and reads without causing worries. Should you shut down your PC before your data is written, the Awesome hangs onto everything till the power comes back, then dutifully scribbles it all to disk.

In addition, the Awesome can compress data, on the fly, to extend disk space while adding enhanced error correction. Also, it automatically defragments your disk while you use it, keeping file clusters contiguous for faster access.

The Awesome optimizes cluster sizes for maximum disk capacity and arranges your data for optimal access speed. It allows you to use an optimal sector interleave and optimal track skewing, which, in conjunction with the on-board buffer, increases the effective hard disk data transfer rate.

Hardware installation is little more than a plug-in—the Awesome requires no cables and only the adjustment of one jumper to turn battery power on.

Despite all the promises and technology, performance-testing of the Awesome I/O Card showed some mixed results.

Average access time—measured using BIOS calls—was halved, due in part to the Awesome's formatting the disk middle rather than the outer edge. Core International's Core Test program, supplied by CSSL with the Awesome, reported lightninglike data transfers and disk accesses.

But fast seek times and transfer rates in controlled settings don't give the full story. Some of the trade-offs necessary in building the Awesome will deteriorate performance in certain situations.

For example, when I used DOS calls to create a file too large to fit into the Awesome 512K-byte buffer, data transfer was actually slower with the card installed. Moreover, when I set up a huge directory hierarchy with multiple small files—a standard task that requires less than 10 megabytes on an all-IBM hard disk system—the Awesome-controlled disk ran out of room on a 20-megabyte hard disk in both the high-speed and compression modes (even though DOS CHKDSK listed disk capacity at 32 megabytes when using the card).

Little can be faulted with the

Awesome I/O Card. It's well made and all the techniques it uses have been proven in larger computer systems. It's a harbinger of things to come—more power in the I/O system of your PC. Just don't expect improvement in every aspect of hard disk use.

PC FACT FILE

Awesome I/O Card CSSL Inc.

909 Electric Ave., #202
Seal Beach, CA 90740
(213) 493-2471

List Price: \$844

Requires: AT or compatible, hard disk drive, controller.

In Short: A hardware-based buffer and hard disk optimizer that works in conjunction with your existing AT disk controller and that has the potential to halve access times and increase storage, under the right circumstances.

CIRCLE 422 ON READER SERVICE CARD



Performance Tests: CMI Hard Disk, with and Without Awesome I/O Card

We tested the Awesome I/O Card in a PC's Limited 12-MHz 286 PC with a CMI 20-megabyte hard disk and a Western Digital 1002 controller. These tests show the benefit of the Awesome's coprocessor and do not take advantage of the 512K-byte buffer.

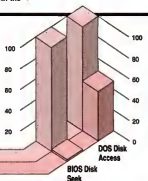
Performance Times (Times given in milliseconds)

	BIOS Disk Seek	DOS Disk Access
CMI hard disk drive	38.22	53.08
CMI hard disk drive with Awesome I/O Card	0.75	25.38

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes various software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

The DOS Disk Access benchmark test measures the time it takes to do a random sector read using DOS. As there are no set 3 and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

Relative Times (CMI hard disk drive = 100)



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CIRCLE 353 ON READER SERVICE CARD

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Rodime's Double Play Disk Puts a Fast Drive In PS/2 Model 50; Throws Model 30 a Bone

PC HANDS ON

BY MITT JONES

It's easy to think of the PS/2 Model 50 as the first personal computer with a disposable hard disk: of course, you're not supposed to throw it away, but most users sure want to.

Double Play, manufactured by Rodime, presents itself as the first high-speed replacement disk for the Model 50's 80-millisecond faux pas.

Installation of the 28-millisecond, 45-megabyte Rodime drive requires that you remove the Model 50's stock drive: the Rodime drive slides into the space vacated by the original. But Rodime's conservation-minded design lets you reinstall the Model 50 drive in a machine worthy of its sluggishness—either a PS/2 Model 25 or 30.

To install the replacement disk, you first slide out the original Model 50 disk and remove its mounting sled by loosening four screws. You then attach the mounting sled to the Rodime drive and slide the disk into place. Clear instructions make installation a cinch.

The disk has a voice-coil ac-

tuator and four plated platters. One platter surface serves as a dedicated servo surface.

Once up and running, your Model 50 will hum as it should have all along. A PC Labs test clocked the Rodime drive at 29.65 milliseconds.

So far, so good. But the smooth execution of the Double Play degrades to sandlot play once you attempt to install the original Model 50 disk drive in a Model 25 or 30. The drive in-

stalls into an empty floppy disk drive bay of either the Model 25 or 30 and requires a half-length controller board that Rodime includes.

Installing the drive in the Model 25 can be an exercise in frustration, in part because of



Rodime's Double Play disk replaces the PS/2 Model 50's sluggish 20-megabyte hard drive (left) with a peppy 45-megabyte drive (right).

cations or orientation.

Worse still, once you've installed the disk you'll find it has a disappointing 113-millisecond average random access rate, apparently as a result of the Rodime-supplied controller's overhigh step rate. Rodime is

working to solve the problem.

As of this printing, Rodime sells the Double Play only as a kit: you can't buy the Model 50 replacement disk without the controller card and cables for the Model 25 or 30.

Rodime scores high with its Model 50 replacement disk. And despite the Double Play's Model 25/30 shortcomings, it at least gives you an alternative to sending your old Model 50 disk to the city dump.



FACT FILE

Double Play

Rodime Inc.
Peripheral Systems Div.
29525 Chagrin Blvd.
Pepper Pike, OH 44122
(216) 765-8414
List Price: \$1,495

Requires: IBM PS/2 Model 50
In Short: A fast, 45-megabyte replacement disk drive for the PS/2 Model 50, along with a kit that lets you install the Model 50 drive in a PS/2 Model 25 or 30.

CIRCLE 438 ON READER SERVICE CARD

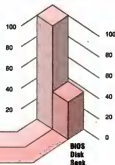
PC Benchmark Tests: Rodime's Double Play vs. IBM PS/2 Model 50 20-Mbyte Hard Disk

Rodime's Double Play nearly triples the speed of the IBM PS/2 Model 50 hard disk. Installed in either the Model 25 or 30, the original Model 50 disk performs at a disappointing 113-millisecond rate.

Performance Times (Times given in milliseconds)

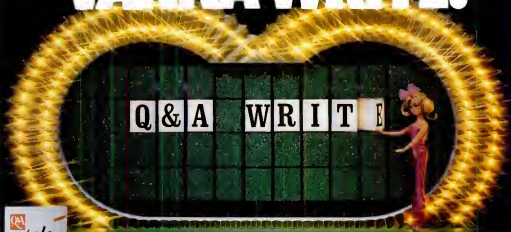
	BIOS Disk Seek
IBM PS/2 Model 50 20-Mbyte hard disk	81.09
IBM PS/2 Model 50 with Double Play	29.65

Relative Times (IBM PS/2 Model 50 20-Mbyte Hard Disk = 100)



The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

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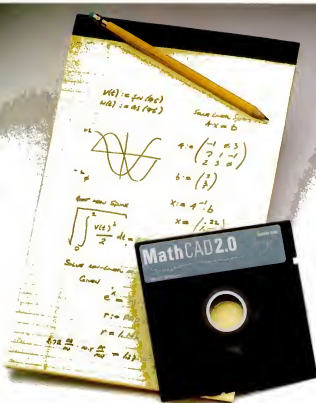
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CIRCLE 268 ON READER SERVICE CARD

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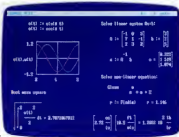
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PC HANDS ON

BY EDWARD MENDELSON

Slowly but surely, soft fonts get less hard—less hard to obtain, less hard to use. Bitstream's *Fontware Installation Kit* is the best font softener yet. It lets you create matching fonts for your screen and printer, and it installs them in *Ventura Publisher* or in *Microsoft Windows* applications such as *PageMaker*. Unlike laser printer cartridges, these top-quality fonts work on a wide range of dot matrix and laser printers.

Soft fonts are still hard on your wallet, though. The \$95 *Fontware Installation Kit* works only in combination with typeface outlines that Bitstream offers at \$195 each. These outlines contain the raw data that

need one of the font managers discussed in the sidebar "Getting Other Programs to Use Fonts" to use with the font outline packages.

Bitstream's kit comes with a sample outline font. You can install the fonts to work with any *Windows*- or *Ventura*-compatible monitor or printer. The *Ventura* version lets you create fonts for PostScript printers; the *Windows* version doesn't.

perb Times Roman design used for the AC soft fonts and the Z cartridge.

Yet if you want less common type styles, or a wide range of sizes, you'll have to get one of Bitstream's outline packages. The current crop includes about 20 different designs, ranging from the monospaced Courier and Prestige and the familiar Times Roman and Helvetica through Bitstream's versions of

Fontware Installation Kit

Font Name	Printer	Font Size (lines)
Bit Charter	Acorn	14 10 24
ITC Avant Garde	Acorn	11 12
ITC Avant Garde	Acorn	11 12
ITC Avant Garde	Acorn	10 10 5 11 12
ITC Avant Garde	Acorn	10 10 5 11 12

Printer

Time needed: 21 minutes
Available disk space is 500K.

Please press any key to continue...

1. Help 2. Install 3. Uninstall 4. Quit

1. Help 2. Install 3. Uninstall 4. Quit

1. Help 2. Install 3. Uninstall 4. Quit

1. Help 2. Install 3. Uninstall 4. Quit

Bitstream's Fontware Installation Kit tells you how long it will take up your computer while making fonts. An 80287 math coprocessor speeds up the job.

Windows applications display and print your new fonts instantly. With *Ventura* you have to take a few clearly spelled out steps before using the fonts, but it's duck soup compared with the way *Ventura* normally installs fonts. Make sure to follow Bitstream's manual and read-me cards in exact detail the first time you use the kit—although the menus are clear enough to let you throw away the manual afterward. You may need to update your printer driver, but if you follow the instructions religiously, Bitstream will guide you through it.

Bitstream licenses its fonts and *Fontware* engine to other vendors, this being the first time the package has been issued by Bitstream itself. In fact, some of the fonts you can generate with *Fontware* are the same ones Hewlett-Packard sells for the LaserJet series, notably the su-

PC FACT FILE

Fontware Installation Kit for Microsoft Windows

Fontware Installation Kit for Ventura Publisher

Bitstream Inc.

Athenaeum House

215 First St.

Cambridge, MA 02142

(800) 522-3668

(617) 497-7512

List Price: \$95 for either version of the installation kit; typeface outline packages, \$195 each.

Requires: 512K RAM, hard disk drive (1.4 Mbytes free), DOS 3.1 or later.

In Short: The easiest way to create and install soft fonts for *Ventura Publisher* or for *Microsoft Windows* applications such as *PageMaker*. Not copy protected.

CIRCLE 421 ON READER SERVICE CARD

such elegant styles as Palatino, Futura, Galliard, Optima, and Garamond. A "headlines" package includes four jazzy and exotic styles called Cloister, Broadway, University Roman, and Cooper Black.

Our constitution is in actual operation; everything appears to promise that it will last;

Our constitution is in actual operation; everything appears to promise that it will last;

Our constitution is in actual operation; everything appears to promise that it will last;

Bitstream's Cloister, Zapf Calligraphic, and Broadway soft fonts, printed on an HP LaserJet Plus printer.

the kit uses to generate the actual fonts you see. First you buy an outline like Times Roman or Garamond; then you select sizes, weights, and character sets from the menu in the installation kit. Finally you wait from a few minutes to a few hours while the kit generates your fonts. The kit will then install the fonts in *Windows* or *Ventura*; it needed 38 minutes of uninterrupted, uninterrupted processing to finish the *Windows* installation of three fonts, in two sizes each, on an IBM PC AT. If you're installing the fonts in another program, you'll

Getting Other Programs to Use Fonts

A few years from now, we'll wonder how we ever put up with this. But in late 1987 and for as far as we can see into 1988, here's what you have to do to use soft fonts when you just want to write and print and do not want to work with a full-fledged desktop publishing package such as *PageMaker* or *Ventura Publisher*.

First you buy a font outline from Bitstream or one of its licensees, like SoftCraft. Then you run the outline through the installation program from either Bitstream or SoftCraft. Either one lets you choose the Hewlett-Packard Roman-8 character set; SoftCraft's also lets you choose other character sets, including IBM's standard 256-character set, which you should choose if

you don't want to spend a few hours telling your word processor how to translate IBM's high-order characters into HP's Roman-8. (The standard lower-ASCII set is the same in both sets; they differ above ASCII 128.)

When you have generated your fonts, you will need to create a printer driver to use them. If you use *WordPerfect* or *Microsoft Word*, the utilities included in VS Software's *VS Toolkit* or Human Touch Software's *Soft Font Manager* create the drivers and hatch files that download all the proper fonts before printing.

If you think there has to be a better way, you're right. But no one has come up with it yet.—Edward Mendelson

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QUICK LOOKS

Soft Font Manager Adds Human Touch

PC HANDS ON

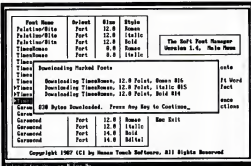
BY EDWARD MENDELSON

If you want to know why *The Soft Font Manager* is the best program of its kind, simply take a look at the name of the company that makes it: Human Touch Software. With this \$49.95 package, you can finally manage LaserJet fonts in terms that human beings can understand. You no longer need to decipher font filenames such as CY120RHP.PFM. Even better, you do not need to retype any of those names. *The Soft Font Manager* checks out your font directory, creates a font list, and then displays a menu with recognizable names such as "Gar-

mond 12-point Roman."

This is one of many human touches in this elegant and intuitive program. Simply by mov-

ing through a menu, you can mark fonts for downloading or create customized "font sets" for later use.



Font Name: Palatino/Bit

The Soft Font Manager lets you download single fonts or maintain customized sets.

The program creates custom printer drivers that enable you to use these font sets immediately with either *WordPerfect* or *Microsoft Word*. Once you have used the menus, you can run the program from the DOS command line.

The Soft Font Manager generates font samples, keeps track of the memory your fonts take up in the printer, and can clear them from memory on command. If it were any more human, it wouldn't fit in your computer.

List Price: *The Soft Font Manager*, Version 1.4, \$49.95. **Requires:** 256K RAM, one disk drive, DOS 2.0 or later. Not copy protected. Human Touch Software, 8795 La Riviera Drive, #100, Sacramento, CA 95836; (916) 369-1261.

CIRCLE 436 ON READER SERVICE CARD

How to Dial Up the Yellow Page Service

PC HANDS ON

BY CATHERINE D. MILLER

American Business Lists has been compiling lists from yellow pages across the country for 15 years. The company first offered on-line access to a portion of its database with its Instant Yellow Page Service in 1984; by 1986 the complete database was available.

The Instant Yellow Page Service is easy to use. Prompts are self-explanatory and the manual has a good run-through of the features the service offers, as well as the codes you'll need to get your data.

You can retrieve phone numbers and addresses of companies by brand/franchise, professional specialty, and three- or five-digit ZIP code, as well as by F.I.P. (Federal Information

Processing) county code and/or S.I.C. (Standard Industrial Classification) code.

For broader ranges of business types, you can use the count option. The number of businesses for the specified range is listed, but the records for the businesses are not retrieved.

American Business Lists still supplies yellow page information in a variety of formats.

But when time is of the essence, you can easily get any yellow page information with the Instant Yellow Page Service.

List Price: Instant Yellow Page Service, \$95 subscription for first year, \$60 annual renewal; \$1 per minute of connect time; 10 cents per name printed or displayed. **Requires:** Modem, communications software. American Business Lists Inc., 5707 S. 86th Circle, Omaha, NE 68127; (402) 593-4593.

CIRCLE 437 ON READER SERVICE CARD

Looking It Up in Funk and Wagnall's

PC HANDS ON

BY PEGGY GAVAN

If you have ever wondered why most computerized reference works are marketed for the CD-ROM arena, wonder no more. Inductel's REference Series demonstrates why the compact-disk method is still the best way to go.

Inductel's *Funk and Wagnall's Standard Desk Dictio-*

nary and Concise Dictionary of 26 Languages should be CD-ROM products, but instead they are distributed on floppy disks (21 to be precise) and accessible only on hard disk drives. In other words, you will have to relinquish 7.2 megabytes to get both products on your hard disk.

So what do you get for sacrificing a third of your 20-megabyte drive?

You get a stripped-down version of the *Funk and Wagnall's*

Standard College Dictionary, including separate biographical and geographical sections, an abbreviation index, a style handbook, and an index on computer terms.

You also get the ability to translate 1,000 words in 26 languages simultaneously — a unique feature you're unlikely to find in book form.

The engine that drives the index, the Knowledge Access System, is clunky but has a rela-

tively fast access time. However, until Inductel releases its planned network versions, you might find it faster to use the books.

List Price: *Funk and Wagnall's Standard Desk Dictionary*, \$79.95; *The Concise Dictionary of 26 Languages*, \$49.95. **Requires:** 256K RAM, 7 megabytes of hard disk storage, DOS 2.0 or later. Not copy protected. Inductel, 18661 McCoy Ave., Saratoga, CA 95070; (408) 866-8016.

CIRCLE 438 ON READER SERVICE CARD



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For more information, call from your modem 1-800-444-4472 (8 bit, no parity, 1 stop bit) and enter the access code NVELS6 when prompted.



For network solutions,
you should be seeing red.

D.A.V.E. Adds Data Entry Forms to 1-2-3

PC HANDS ON

BY ELLEN R. S. BUSH

Have you ever wished you could enter data into a spreadsheet using a dBASE-like input screen? Dreamed that 1-2-3 could perform validity checks? Goldata Computer Services' D.A.V.E. (Data Addition, Verification, and Editing) turns these dreams into reality. D.A.V.E. has two programs: an image definition module and a

1-2-3 add-in. The image definition module is an external program called from the DOS prompt, while the add-in is called by a "hot key" in 1-2-3 and brings up its own menu of options.

The image definition module allows you to create an input screen (image) simply by painting the layout on the screen. Fields are defined by a name, a column location in the spreadsheet, a data type, and a width.

A simple layout, similar to a

noncustomized dBASE data entry screen, can be created from the spreadsheet using the add-in. D.A.V.E. uses the field heading as a screen label but uses the column label as a field name to avoid duplication. The data type and width are determined by the format and width of the first nonblank cell below the heading. A screen created here can be customized in the image definition module.

Unlike dBASE, D.A.V.E. does not require programming for extensive input verification. You can specify whether a field is mandatory or optional. Field entries can be checked for upper and lower bounds or uniqueness, or they can be matched against a specified list, range of the database, or external ASCII file. Unfortunately, verification of character fields is not case sensitive, so errors may result when data is used as input to an @lookup function.

D.A.V.E.'s verification capabilities are not limited to input data. The program has the capability to check existing spreadsheet data to see if it meets the conditions of a D.A.V.E. image. This can be done interactively,

letting you change "misfit" information as it is detected, or in a batch mode that creates a report of errors found.

Once again Goldata has provided good documentation and customer support for a brilliantly conceived product. I'd like to see case-sensitive verification and spreadsheet formatting, but I'll happily work around these problems for now.



FACT FILE

D.A.V.E.

Goldata Computer Services Inc.
2 Bryn Mawr Ave.
Bryn Mawr, PA 19010
(215) 525-1098
List Price: \$149.95

Requires: 512K RAM; two disk drives; 1-2-3, Release 2.0; DOS 2.0 or later.

In Short: An easy-to-use way to use data entry forms and data validation in 1-2-3. Not copy protected.

CIRCLE 423 ON READER SERVICE CARD



Believe it or not, this input screen is for a 1-2-3 spreadsheet.

Deja! Pokes into dBASE Files While You Are Working in 1-2-3

PC HANDS ON

BY DONALD B. TRIVETTE

The word *déjà* is French for "already." It's also the name of a new add-in product for Lotus's 1-2-3 that allows spreadsheets to directly read and manipulate the data in dBASE III Plus files. *Deja!*, from PC Publishing, may be installed in an auto-load mode so that it's always present when 1-2-3 is active; or it may be installed only when needed by using 1-2-3's Add-in Manager. Either way, when *Deja!* is activated by a "hot-key" combination, it presents a menu bar

across the top of the screen that is *déjà* vu—the design is so familiar you'd swear you've been using it for years.

The main menu has commands for Open, Locate, Filter, Transfer, Database, Record, and Quit. /O brings up the command to open a dBASE III file. Locate finds a particular record in that file, and Filter extracts a subset of its records. The Transfer command imports a .DBF file into 1-2-3 or exports it from 1-2-3 back to dBASE. Using Transfer with Filter, you can select and copy records based on a variety of tests—perhaps all employees in the Milwaukee of-

fice hired after a certain date.

If you know how to work with 1-2-3, you know how to use *Deja!*, although a clearly written 116-page instruction manual and tutorial is included.

The only blemish I can find in *Deja!* is its glacial speed. On an XT, filtering 37 records from a file of 1,500 takes 30 seconds. To import those 37 records into a spreadsheet requires 48 seconds; however, the reverse, from spreadsheet to database, is almost instantaneous.

When you have the only product that allows the most popular spreadsheet program to talk directly to the most popular



FACT FILE

Deja!, Version 2.0

PC Publishing Inc.
1801 Ave. of the Stars, #800
Los Angeles, CA 90067
(800) 634-4555
(213) 556-3630
List Price: \$129.95

Requires: 320K RAM; 1-2-3, Release 2.x; DOS 2.0 or later. Hard disk recommended.

In Short: An easy-to-use add-in program that allows 1-2-3 to read, import, export, and alter the records in dBASE III files. Not copy protected.

CIRCLE 424 ON READER SERVICE CARD

database program, you don't worry too much about speed. You have a winner.

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And use them they do. In fact,

we average 3,700 calls per day. Which creates an uncomfortable moment when the phone bill arrives each month.

But we get over it. We know that customer satisfaction is a valuable asset. And realize that next to a great product, it's the most valuable asset a company can have.

So when you get the urge to discuss a WordPerfect product, give us a call. And the next time you get a hefty phone bill, think of us. We sympathize.



WordPerfect
CORPORATION

CIRCLE 513 ON READER SERVICE CARD

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Let's face it, backing up is a chore that some of us would just as soon forget about. And quite often we do! But forgetting to make frequent backups of your hard disk data is no laughing matter. In this day and age losing just a few days worth of data can be disastrous. That's why we developed QuickSave, a fast, reliable backup program with a built-in "Backup Alert" that can actually prevent the data losses associated with "Infrequent" backups. Simply install QuickSave on your PC and tell it how often you want to backup your data (you can track up to 9 different backup schedules at a time) it's that easy! Now you can rest assured, because QuickSave will always be on guard, silently monitoring your computer's backup status. And, when it's time to backup, QuickSave will alert you, then automatically backup your data for you. Whether you're an individual user, or a corporate manager with a lot of forgetful employees, QuickSave gives you the absolute data security you need.

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In addition to maintaining your backups and providing you with the fastest backup around, we also protect your backup disks with the most advanced error correction in the industry. QuickSave can detect and correct up to 3,200 errors per floppy disk. That's right, we said 3,200 errors per disk.

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Micro Interfaces, Corp. 16359 NW 57th Avenue, Miami, Florida 33014. Telex # 5106004680 MICRO INTER CO.

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CIRCLE 333 ON READER SERVICE CARD

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—PC MAGAZINE
September 15, 1987

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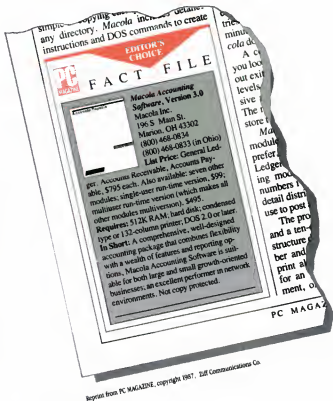
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NEW ON THE MARKET

PC Viewer+2 Downloads 75 Presentation Screens for Use with Overhead Projector

The PC Viewer+2, from In Focus Systems, interfaces your PC with a standard overhead projector. The "electronic transparency" plugs into the graphics adapter port on your PC. It displays whatever would normally appear on your screen as an LCD pattern that the overhead projects as it would a conventional overhead foil.

A megabyte of display memory allows up to 75 PC-generated screens to be downloaded directly to the PC Viewer. This enables the unit (which fits comfortably into a briefcase) to store and replay computer-generated graphics presentations independently from the host computer. The \$2,495 PC Viewer provides 640 by 480 resolution in either normal or reverse video and is compatible with PS/2 display formats. An infrared remote control allows



windowing, scrolling, and other effects.

In addition to PS/2 displays, the PC Viewer is compatible with CGA and EGA display formats.

List Price: PC Viewer+2, \$2,495. **Requires:** CGA, EGA, or VGA;

The \$2,495 PC Viewer+2, from In Focus Systems, can store and replay up to 75 computer-generated presentation screens on a standard overhead projector.

overhead projector. In Focus Systems Inc., 7997 S.W. Mohawk St., Tualatin, OR 97062; (503) 692-4968.

CIRCLE 429 ON READER SERVICE CARD

adapters that require external transceivers, according to 3Com. The company says the on-board transceiver reduces the cost per connection by \$200 to \$300. The EtherLink/MC also uses 3Com's Link Level Library, which makes it easier for software developers to port their products to EtherLink/MC.

Ethernet/MC allows PS/2 machines to run all versions of 3Com's 3 Plus software in a 10-megabit-per-second Ethernet environment.

List Price: EtherLink/MC, \$595. **Requires:** PS/2 Model 50, 60, or 80. 3Com Corp., 3165 Kifer Rd., Santa Clara, CA 95052; (408) 562-6400.

CIRCLE 433 ON READER SERVICE CARD

IDEAssociates Debuts Add-In RAM Board with Up to 12 Megs in a Slot

Whether you are betting on Microsoft Windows/386, OS/2, or some souped-up future version of DOS, you are going to need quite a lot of memory before too long. IDEAssociates has introduced a new add-in memory board that should pack as much memory as you will need into a single expansion slot.

Future Domain Unveils An SCSI Host Adapter For the PS/2 Machines

Hardware products that are designed for the IBM PS/2 Micro Channel bus continue to appear. Future Domain Corp. has now added an SCSI host adapter to the list of choices available to owners of IBM's new PS/2 machines.

The \$390 MCS-350 SCSI adapter interfaces with the Models 50, 60, and 80 and a variety of SCSI peripherals, according to Future Domain. The adapter has a transfer rate of 1.67 megabytes per second. It is fully compatible with the Micro Channel bus, the company says, and has IBM-assigned ID numbers.

List Price: MCS-350, \$390. **Requires:** PS/2 Model 50, 60, or 80. Future Domain Corp., 1582 Parkway Loop, Suite A, Tustin, CA 92680; (714) 259-0400.

CIRCLE 432 ON READER SERVICE CARD

3Com's Adapter Links IBM's PS/2 Computers To Ethernet Networks

3Com Corp. has unveiled an adapter, the \$595 EtherLink/MC, that links PS/2 Mod-

els 50, 60, and 80 to Ethernet networks.

The new board features an on-board Ethernet transceiver. That makes the Ethernet connection less costly, more reliable, and easier to install than

Laptop Sports an 80286 Microprocessor, 20-Meg Hard Disk in 14-Pound Package

A feature-packed laptop PC comes to the United States from an unlikely direction—north. The Canadian-designed and -built System IV laptop, from Ogivir Technologies, has an 80286 microprocessor running at 10 MHz, a 20-megabyte hard disk drive, and a 640- by 400-pixel gas plasma display. The \$4,395 machine also features a 3½-inch microfloppy disk drive and weighs in at a svelte 14 pounds.

Base system RAM is 640K bytes, and the System IV also

has a proprietary expansion slot that accepts either a 3-megabyte RAM card or a 300/1,200-bit-per-second Hayes-compatible modem. Two RS-232C ports are standard, along with a single parallel port and a clock/calendar. Ogivir says the System IV will run MS-DOS/2.

List Price: System IV, \$4,395. Ogivir Technologies, 7200 Trans Canada Hwy., Ville St. Laurent, Montreal, Quebec, Canada H4T 1A3; (514) 737-3340.

CIRCLE 430 ON READER SERVICE CARD



At \$4,395, Ogivir Technologies' System IV isn't inexpensive. But the laptop system has a solid complement of features.



The IDEAmix/MC add-in memory board (\$495 with 512K) can hold up to 12 megabytes of memory in a single expansion slot. Up to 8 megabytes can be configured as LHM expanded memory.

The \$495 IDEAmix/MC supports up to 12 megabytes of memory for the PS/2 Models 50, 60, and 80. You can allocate up to 8 megabytes as Lotus/Intel/Microsoft expanded memory. The board uses 1-megabyte single in-line memory modules (SIMMs) but also accepts

256K-byte SIMMs if less memory is needed.

List Price: IDEAmix/MC with 512K, \$495. **Requires:** PS/2 Model 50, 60, or 80. IDEAssociates Inc., 29 Dunham Rd., Billerica, MA 01821; (617) 663-6878.

CIRCLE 434 ON READER SERVICE CARD

HP, Known for Lasers, Introduces High-Speed 24-Pin Dot Matrix Unit

Lasers are supposed to take over the printer world, but obviously Hewlett-Packard Co. doesn't think that is happening just yet. The \$1,695 RuggedWriter 480, HP's first entry into the 24-pin dot matrix market, has a claimed print speed of 480 characters per second in draft mode. HP reports a speed of 240 cps for letter quality print, and it asserts that the RuggedWriter is the fastest 24-pin printer around.

The unit is intended for small businesses and work groups in larger organizations. With a reported 20,000 hours meantime between failures, the printer is designed for heavy, continuous use.

Three independent paper paths support hand-fed sheets,

fanfold paper, and automatically fed cut sheets. Other paper-handling features include automatic paper loading, four-part form capability, and a cut sheet feeder option.

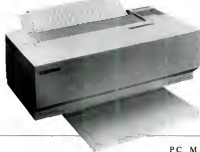
The RuggedWriter's front panel has pushbuttons for selection of three 10-pitch typeface settings and speeds.

Graphics of up to 180- by 360-dot-per-inch resolution can be generated with the RuggedWriter. The printer has two switch-selectable-mode formats: the HP Printer Command Language or Epson LQ-1000 emulation. A 2K-byte buffer is standard and can be expanded to 16K.

List Price: RuggedWriter 480, \$1,695. For more information, call the Hewlett-Packard Co. sales office listed in the telephone directory (white pages).

CIRCLE 431 ON READER SERVICE CARD

Hewlett-Packard Co.'s RuggedWriter (\$1,695) is intended for heavy, continuous use. HP reports a draft-mode print speed of 480 characters per second.



The Display Font Pack Offers Headline Fonts For Desktop Publishing

The Display Font Pack, \$95 from SoftCraft, is a set of HP soft-font-format fonts for use with laser printers and with Ventura Publisher, Aldus's PageMaker, and Microsoft Windows. The WYSIWYG typefaces are for headlines and other display type.

The fonts can be used in either portrait or landscape orientation.

List Price: Display Font Pack, \$95. **Requires:** Ventura Publisher, Version 1.1, with HP, AST, Cordata, or J laser printers; or Aldus's PageMaker, Version 1.0A; or Microsoft Windows with the HPCLC printer driver for the LaserJet Plus, Series II, and compatible printers. CGA, EGA, or Hercules adapter required to display screen fonts. Not copy protected. SoftCraft Inc., 16 N. Carroll St., # 500, Madison, WI 53703; (800) 351-0500.

CIRCLE 439 ON READER SERVICE CARD

HOT PROSPECT \$599 Add-in VGA Board Increases Speed, Resolution, Color Capabilities

The \$599 Paradise VGA Professional Card outshines its IBM equivalent, according to Paradise Systems. The card is register and software compatible with the VGA standard, Paradise says, and boosts graphics speed, resolution, and color capabilities of AT, PS/2, and 80386 machines.

Designed to drive multifrequency and PS/2 analog monitors, the card provides maximum monochrome resolution of 1,024 by 768 pixels and maximum color resolution of 800 by 600 pixels with 16 colors displayed. The VGA Professional Card can display up to 256 simultaneous colors from a palette of 262,144, at 640- by 480-pixel resolution. That is equivalent to MCGA color graphics at the higher VGA resolution, according to Paradise. By contrast, IBM's VGA has a maximum color resolution of 640 by 480 and displays a maximum of 16 colors.

The VGA Professional Card is based on the Paradise PVGA1 video controller chip and is compatible with IBM's VGA video controller on the PS/2 Models 50, 60, and 80. The card is also compatible with earlier IBM video modes, including EGA, CGA, and MDA, and with Hercules monochrome.

Paradise claims the VGA Professional Card is up to 50 percent faster than IBM's VGA add-in card.

Paradise will supply the drivers for Microsoft Windows, 1-2-3, AutoCAD, Ventura Publisher, and WordPerfect, among others.

List Price: Paradise VGA Professional Card, \$599. **Requires:** AT, XT, or PS/2 Model 25 or 30; PS/2 analog monitor or multifrequency monitor; expansion slot. Paradise Systems Inc., 99 S. Hill Dr., #42, Brodhead, CA 94005; (415) 468-6566.

CIRCLE 428 ON READER SERVICE CARD



The \$599 VGA Professional Card, from Paradise Systems, displays up to 256 simultaneous colors at 640- by 480-pixel resolution.

PC UPDATE

edited by Peggy Gavan

MultiMate Advantage II LAN Version

MultiMate Advantage II LAN, a network version of the Ashton-Tate word processor, offers standard LAN features and operates on most networks, including IBM's Token-Ring Network and PC-Net, and network operating systems such as Novell's **Advanced NetWare/86** and **286** and 3Com's **3 Plus**. The LAN Pack, which has one server and five workstation modules, is priced at \$1,495. Registered users should call customer service at (203) 522-2116 for upgrade prices and information. Ashton-Tate, Torrance, Calif.; (213) 329-8000.

PageMaker Portfolio

PageMaker users can now produce professional business documents with **PageMaker Portfolio: Designs for Business Communications**, second in the **PageMaker Portfolio** template series. **Designs for Business Communications**, priced at \$99, includes 18 templates with pre-designed page formats for proposals, transparencies, reports, and business plans. Aldus Corp., Seattle, Wash.; (206) 628-2352.

Fastback Plus

Fastback Plus, a restructured version of the **Fastback** hard disk backup program, features improved data compression and a pop-down-menu user interface adaptable to the novice or power user. **Fastback Plus** retails for \$189. Registered users who purchased the original version prior to September 1 can upgrade for \$45, or for \$20 if purchase was made after that date. Fifth Generation Systems, Baton Rouge, La.; (504) 291-7221.

PC Paintbrush Plus, Publisher's Paintbrush

PC Paintbrush Plus and **Publisher's Paintbrush**, Versions 1.5, accept 16 levels of gray scale output from several scanners, including the HP Scanjet, Ricoh models SS-30 and IS-30, and any scanner with the Ricoh ISI-8 interface board. The new versions can also print graphics in gray scale on several printers and plotters. **PC Paintbrush** and **Publisher's Paintbrush** are priced at \$149 and \$285, respectively. Upgrades are \$40 and \$55 for registered users. Z-Soft Corp., Marietta, Ga.; (404) 980-1950.



Before and after: The new versions of **PC Paintbrush Plus** and **Publisher's Paintbrush** (right) now display and print 16 levels of gray scale on several output devices.

Epson Equity II Plus, Equity III Plus

Epson America has announced the **Equity II Plus**, a small-footprint AT compatible that replaces Epson's **Equity II** model. The **Equity II Plus**, priced at \$1,595, has an 80286 processor with speeds of 8 or 10 MHz, 640K bytes of memory, a 1.2-megabyte floppy disk drive, parallel and serial ports, and six option slots. A 40-megabyte fixed disk version is available for



Epson's **Equity II Plus**, a small-footprint AT compatible, features a dual-speed 80286 microprocessor (8 or 10 MHz) and an optional 40MB hard disk drive.

\$2,795. Epson has also upgraded its **Equity III**, adding an 80286 processor that can operate at 8, 10, or 12 MHz. The **Equity III Plus** is priced at \$2,295 with one floppy disk drive and at \$3,495 with a hard disk. Epson America, Torrance, Calif.; (800) 421-5426.

IN BRIEF

Relay Gold is now available in a network version for the IBM PC-Net, the IBM Token-Ring Network, Novell networks, and other NETBIOS-compatible networks. The network version retails for \$250, plus \$75 per node. Registered users can upgrade for \$40 per node. VM Personal Computing, Danbury, Conn.; (203) 798-3800 . . . Software Publishing Corp. has cut the price on its **PFS:Professional Plan** spreadsheet from \$249 to \$99. SPC, Mountain View, Calif.; (415) 962-8910.

PS/2 WATCH

IBM PS/2 Model 60

IBM cut the list price of the 70-megabyte-equipped PS/2 Model 60 by \$500. The Model 60-071 now has a suggested retail price of \$5,795. The price of the Model 60-041 remains at \$5,295. Contact a local IBM dealer for more information.

Program in the fast lane with Borland's new Turbo Pascal 4.0!

Our new Turbo Pascal[®] 4.0 is so fast, it's almost reckless. How fast? Better than 27,000 lines of code per minute.* That's more than twice as fast as Turbo Pascal 3.0.

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- Compiles 27,000 lines per minute
- Includes automatic project Make
- Supports > 64K programs
- Uses units for separate compilation
- Integrated development environment
- Interactive error detection/location
- Includes a command line version of the compiler
- Highly compatible with 3.0



4.0 breaks the code barrier

No more swapping code in and out to beat the 64K code barrier. Designed for large programs, Turbo Pascal 4.0 lets you use every byte of memory in your computer.

4.0 uses logical units for separate compilation

Pascal 4.0 lets you break up the code gang into "units," or "chunks." These logical modules can be worked with swiftly and separately. 4.0 also includes an automatic project Make.

4.0's cursor automatically lands on any trouble spot

4.0's interactive error detection and location means that the cursor automatically lands where the error is. While you're compiling or running a program, you get an error message and the cursor flags the error's location for you.

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Sieve (25 iterations)

	Turbo Pascal 4.0	Turbo Pascal 3.0
Size of Executable File	2224 bytes	11682 bytes
Execution speed	9.3 seconds	9.7 seconds

Sieve of Eratosthenes, run on an IBM[®] IBM AT

Since the source file above is too small to indicate a difference in compilation speed we compiled our CHES program from Turbo Pascal 4.0 to give you the same of how much faster 4.0 really is.

Compilation of CHES.PAS (5469 lines)

	Turbo Pascal 4.0	Turbo Pascal 3.0
Compilation speed	12.1 seconds	35.5 seconds
Lines per minute	27,119	9,243

CHES.PAS compiled on an 8 MHz IBM AT

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If you are a registered Turbo Pascal user and have not been notified of Version 4.0 by mail, please call us at (800) 543-7543. To upgrade if you have not registered your product, just send the original registration form from your manual and payment with this completed coupon to:

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4505 Scotts Valley Drive, Scotts Valley, CA 95066**

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This offer is limited to one upgrade per valid registered product. It is good until November 30, 1987. Not good with any other offer from Borland. Please allow 4 to 6 weeks for delivery of Turbo Pascal 4.0. Outside U.S. make payments by bank draft payable in U.S. dollars drawn on a U.S. bank. CDSs and purchase orders will not be accepted by Borland.

*To qualify for the upgrade price you must give the serial number of the equivalent product you are upgrading.

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Norton Scores Again with \$100 Pop-up Guides for Programmers

PC HANDS ON

BY STEPHEN RANDY
DAVIS

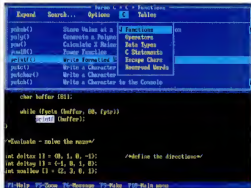
Manuals for programming languages are fraught with problems. Either they're bound like a novel so that they don't lie flat on your desk, or they're ring-bound like a school binder so the pages don't stay in. Either they're so small that the text makes your eyes bleed, or they're so large, you can't find space to store them. And no matter what kind of manual you have, it's always over on the bookshelf instead of by your computer when you need it. Peter Norton Computing has just solved those problems with *The Norton Guides*.

Simply put, *The Norton Guides* is a set of on-line, pop-up manuals. Once a Guide is installed, entering the user-definable "hot key" instantly brings up a window with a menu bar across the top. The details of the menu vary according to Guide, but the basics are the same for all. Can't remember all the on-

tions for "printf()" in C? With the C Guide installed, just select Search and enter "printf". Once printf is found, selecting Expand opens up some 13 pages of information on printf taken mostly from the original C language manual, with extra comments from Peter Norton and his staff.

The pop-up program itself is not specific to any particular

language, relying instead on specially prepared database files for the help information. You purchase these language databases separate from the program disk. More than one database can be accommodated in the same directory. You select which file to use from the options menu. Once it is installed, the Guide can be popped up at any time and from anywhere on



Call for some assistance in the middle of a program, and The Norton Guides will bring you help for the function that is under your cursor.

\$99 Beyond BAT Extends DOS Commands

PC **HANDS ON**

BY MERV ADRIAN

Relay Gold, the communications program, is impressive for reasons other than its good control over remote file transfers. VM Personal Computing found many of its customers were using the **Relay Gold Customizer's** Toolbox for noncommunications-related chores, like setting up menu-driven systems, unattended operations, and data entry routines with extensive help capabilities.

Recognizing a good thing, VM has unbundled the DOS extensions into *Beyond BAT*.


There's plenty in *Beyond BAT* to help program developers. Among these are a simple yet powerful screen language, which allows for modular construction of procedures; screens are kept in a panel file, help screens in a help file, and so on.

Procedures can be grouped together in a library, which is read-only and not accessible after creation. This is an excellent way to create tamper-proof turnkey applications.

You have a number of options at start-up time, including the ability to log all activity. *Beyond BAT* can run resident, when it will take 5K to 165K bytes of RAM, or it can be used

in standalone mode. In partially resident mode (the 5K option), you are using a kernel to call the rest of the preprocessor as needed. Other features include environmental variables, conditional processing, parameter passing, and true chaining and calling of other batch files.

All this power is available at a reasonable price (\$99), but the manual needs some work. A good introduction for users is in order here—a tutorial would be helpful, although the sample applications are not bad.

If you are looking for a way to extend your ability to provide DOS-based applications, this is an excellent place to start. 

PC FACT
FILE

The Norton Guides

Peter Norton Computing
2210 Wilshire Blvd.
Santa Monica, CA 90403
(800) 451-0303 (ext. 40)
(213) 453-2361

List Price: *Instant Access Program*, \$50; language databases (assembly, BASIC, C, or Pascal), \$50 each.

Requires: 256K RAM, hard disk drive, DOS 2.0 or later.
In Short: A pop-up help manual for programmers. Not copy protected.

CIRCLE 425 ON READER SERVICE CARD

your hard disk—it will find its help file back in its home directory.

Peter Norton Computing sells Guides for assembly language, C (both Turbo and Microsoft), Turbo Pascal, and BASIC (including BASICA, QuickBASIC, and Turbo Basic). Supplied on the program disk is a *Norton Guide* compiler and linker, which allow you to build custom help databases. I give the Norton people high marks for polish on this package. The program is well conceived and easy to use.

PC FACT
FILE

Beyond BAT

VM Personal Computing Inc.
41 Kenosia Ave.
Danbury, CT 06810
(800) 222-8672

List Price: \$99
Requires: 256K RAM, one disk drive, DOS 2.0 or later.
In Short: An applications generator with its own language and screen handler. Not copy protected.

ADDITIONAL READER-SERVICE CARD

Borland's new Turbo C: The most powerful optimizing compiler ever

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Michael Abrash,
Programmer's Journal ”

Join more than 100,000 Turbo C enthusiasts. Get your copy of Turbo C today!

Technical Specifications

- ✓ **Compiler:** One-pass optimizing compiler generating linkable object modules. Included is Borland's high-performance Turbo Linker.[™] The object module is compatible with the PC-DOS linker. Supports tiny, small, compact, medium, large, and huge memory model libraries. Can mix models with near and far pointers. Includes floating point emulator (utilizes 8087/80287 if installed).
- ✓ **Interactive Editor:** The system includes a powerful, interactive full-screen text editor. If the compiler detects an error, the editor automatically positions the cursor appropriately in the source code.
- ✓ **Development Environment:** A powerful "Make" is included so that managing Turbo C program development is highly efficient. Also includes pull-down menus and windows.
- ✓ **Links with relocatable object modules created using Borland's Turbo Prolog[™] into a single program.**
- ✓ **Inline assembly code**
- ✓ **Loop optimizations.**
- ✓ **Register variables.**
- ✓ **ANSI C compatible.**
- ✓ **Start-up routine source code included.**
- ✓ **Both command line and integrated environment versions included.**
- ✓ **License to the source code for Run-time Library available.**

Sieve benchmark

	<i>Turbo C</i>	Microsoft [®] C
Compile time	2.4	13.51
Compile and link time	4.1	18.13
Execution time	3.95	5.93
Object code size	239	249
Execution size	5748	7136
Price	\$99.95	\$450.00

*Benchmark run on an IBM PS/2 Model 60 using Turbo C version 1.0 and the Turbo linker version 1.0, Microsoft C version 4.0 and the MS overlay linker version 3.51

Minimum system requirements: IBM PC, XT, AT, PS/2 and true compatibles. PC-DOS 3.05-3.06/3.11 or later. 286K.

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CIRCLE 530 ON READER SERVICE CARD

COMMUNIQUE

edited by Bill Howard

Amazing Facts I

"Compaq Portable III Model 20: The only full-function portable computer under 20 pounds."

—Carolina Computer Stores ad, Raleigh NC News and Observer, September 30, 1987

Amazing Facts II

"Other [Phoenix Technologies] products include . . . Network Server ROM BIOS Plus, which can be used to optimize XT, AT, and 80386-based systems as diskless servers."

—MIS Week, September 21, 1987

Amazing Facts III

"The [Model 80] . . . can support up to 16 Megabytes of memory, in contrast to the origi-

nal PC, which was limited to 0.64 MB."

—American Papermaker, September 1987

Amazing Facts IV

"Edward Esber [is] chairman and chief executive of Ashton-Tate Co., the third-largest PC software concern and the maker of dBASE III, the biggest-selling spreadsheet program for IBM-compatible PCs."

—The Wall Street Journal, September 25, 1987

Amazing Facts V

"[Hewlett-Packard's new Vectra PC] includes 5 1/4-inch flexible-disc drives, which are compatible with IBM PS/2 PCs."

—Reuters story printed in The Seattle Times, September 22, 1987

Truth in Advertising

The slogan of Solar Systems Software of San Bruno, Calif., is "Over a tenth of a decade of traditional American software."

Huh?

"News Flash . . . August 1, 1987. TDS Opens Orange County Office. Call for Phone No."

—Thomas Data Systems newsletter, August 1987

The quest for quality

The logo to your left was designed by Len Massaglia, art director for the Cabaret Promotion Art Department. It adorns our cover story in this issue, and you will be seeing it several more times before the year is out.

The purpose of the logo is to alert you to the fact that our cover story — on David T. Kearns and Xerox Corp. — is the first of a six-part series to appear in ELECTRONIC BUSINESS on "Keeping America Competitive." In this issue, chairman Kearns talks about issues of quality control. The logo is near and dear to him and to the heart of his office.



ISSUES, ELECTRONIC BUSINESS, SEPTEMBER 1987

The quest for quality starts at home: "The logo to your left" is to your right in the October 1, 1987, issue of Electronic Business.

A Machine Would Not Want Your Job

"The Social Security System has installed IBM 4381 processors at its head office in Quezon City to enhance its services to more than 10 million members."

—Philippine Daily Inquirer (Manila), October 1, 1987

Physician, Heal Thyself

A one-page customer letter from Reference Software promoting its speller/thesaurus tools contains four spelling and grammar errors.



Digital has it now. And if you live downwind, you should have the cloud in a day or two. (Information Week cover, September 14, 1987)



"Hang on a sec . . . it's requesting your user name and password."

Have you heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? Send your offerings to *Communique's*, PC Magazine, One Park Avenue, New York, NY 10016, or MCI Mail 157-9301. Please print your name legibly and include your T-shirt size. Contributors will receive \$50 and a PC Magazine T-shirt. In case of duplicate entries, the earliest postmark prevails. Sorry, but entries cannot be acknowledged.

Winners this issue: Bruce Newman (Digital's atom bomb), Dave Bushong (quest for quality), W. Frank Howard (Compaq Portable III Model 20), Jeff Shima (diskless servers), Brent Nelson (0.64 MHz), Philip Hosker (dBASE III), D. C. Georgia (HP Vectra), Tony Nihua (tenth of a decade), Fyv Cardenas (IBM 4381 professors), Kevin Leary (news flash), Doug Reed (Reference Software).

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12 MHz Throughput

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- 640K 100 Nano Seconds, 0 wait state DRAM installed, expandable to 1024KB

System Price **\$1049⁰⁰**

STANFORD 286-10/2

6/10 MHz

Same configuration as in System 286-16 except,

- Regular size AT main board & chassis
- 640K (120 N/S) DRAM on board
- Phoenix BIOS

System Price **\$949⁰⁰**

STANFORD 4.77/10

- 4.77/10 MHz, software switchable M/B
- Phoenix BIOS, Norton SI-3.3
- Socket for 8087 math co-processor
- 640K 120 N/S DRAM on board
- Floppy drive controller
- 360K floppy drive
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- Keyboard lock, Power LED
- 150 watt power supply
- 8 expansion slots
- High quality, heavy duty packaging

System Price **\$529⁰⁰**

STANFORD 286-16

10/12 MHz Zero Wait State
16 MHz Throughput

- Compact size AT main board
- Intel 80286-12 CPU, 10/16 MHz software (keyboard) switchable clock
- Award BIOS, Norton SI-3.3
- 1024KB (one megabyte) 80 Nano Seconds, 0 wait state DRAM, installed
- High capacity floppy controller card
- 1.2 MB floppy drive
- Serial port (Com 1), optional 2nd serial port (Com 2), parallel port, and game port
- 8 expansion slots (6-16 hits, 2-8 hits)
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STANFORD 4.77/8

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- 640K 150 N/S DRAM, Norton SI-1.7
- Stanford or Phoenix BIOS

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21 MHz Throughput

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- Norton SI: 21 (Processor Speed)
- 200 watt P/S, 110/220V selectable
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- 512K interleaved 32 bit RAM on board
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- 2-32 hit, 4-16 hit & 2-8 hit expansion slots
- Supports 80387 math co-processor
- Phoenix or Award BIOS
- High capacity floppy controller card
- 1.2 MB floppy drive
- Serial port (Com 1), optional 2nd serial port (Com 2), parallel port, & game port
- Hardware Reset and Turbo L.E.D.
- Clock/calendar with battery backup
- Enhanced keyboard (101 keys)
- Complete documentation included
- High quality, heavy duty packaging

System Price **\$2058⁰⁰**

STANFORD 386-16/1

6/16 MHz Zero Wait State
19 MHz Throughput

Same configuration as in System 386-18 except,

- Intel 32 Bit 80386 CPU (16 MHz), 6/16 MHz software (keyboard) switchable clock
- Norton SI: 18.7 (Processor Speed)

System Price **\$1979⁰⁰**

STANFORD 386-16/2

Same configuration as in System 386-16/1 except includes socket for 80287 math co-processor.

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■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

GETTING PERSONAL



The machine we so glibly call a PC is the biggest aid to productivity the world has seen. Yet a wide gulf looms between what PCs currently do for us and what they could be doing.

What is a personal computer, anyway?

From *PC Magazine's* point of view, a personal computer is a device that helps you work faster, better, and smarter. That, too, is our long-standing definition of the Productivity section of this magazine. We devote many pages to the tips, tricks, and techniques that help you get the maximum out of the hardware and software you use every day.

The issue in this column, however, is not what the personal computer is doing for you, but what it isn't doing for you. Let's cover the known ground quickly. Word processing is the biggest boon to clear expression and better writing since quills replaced chisels. Spreadsheets have saved companies hundreds of millions of dollars and have doubtless had a measurable effect on our GNP. PC-based database programs affect everything, from Rolodexes to mainframes. Connectivity is making the promise of workgroup computing come true, while causing application developers to rethink their approach to shared information. Programming languages give designers unprecedented and unparalleled freedom of expression. Other, more-specialized applications, such as CAD, project management, presentation graphics, engineering, and scientific data acquisition, reach far beyond their roots thanks to the PC.

Now let's look at all the things the PC should be doing for us. Some of them are well within the reach of today's technology. Others will take years to come to fruition.

SPEAK TO ME Take voice input, for example. The state of the art in voice recognition today is hardly better than it was 10 years ago: a thousand words spoken by one person or one word spoken by a thousand people. The hardware has gotten smaller and faster, but that's a given.

Then again, what do you do with voice input? "Launch all missiles"? Too risky. "Down-down-down-left-one-point-four-five-enter"? Too dumb. Writing letters? Consider all those self-important guys you've seen, muttering sotto voce into some overpriced black chrome microcassette recorder. Did you ever get a letter from one of them? They generally read like the "before" example in a course on effective business correspondence.

So what are real voice-input applications? Utilities. Quick notes. Placing phone calls. Talking your own personal shorthand to your machine to get the job done: "Show me the budget. Back up the

hard disk. Remind me to call Trainor on the 15th." That sort of thing. Of course, you'll also want a complete answering machine with store-and-forward capabilities. You can have some of these services today in products such as *Watson* and *The Complete PC*. The goal is for your secretary or administrative assistant to start doing useful work instead of being a slave to your telephone, your voice, and your incredibly bad handwriting.

Obviously, you will be able to call in for your voicemail, but you should also be able to call your future PC from any push-button phone and have it read you your incoming e-mail. With well-developed voice recognition, you'll be able to respond with voicemail in addition to hard-copy or e-mail.

MAKING IT WORK A personal PC will also need a new class of software. Today's notepads, text databases, and card file programs are the first step. *DayFlo Tracker* lets you throw facts at it in structured and unstructured ways. However, you have to specify the indexing keywords. *AskSam* and other text databases can index and retrieve massive amounts of data very quickly. *Memory Mate* indexes every word, which means you can retrieve anything from any scrap you can recall. It, however, is somewhat limited in the number of items it can keep in memory at once.

I'm looking for a hybrid product that doesn't care how my data is structured, knows how often I use different kinds of information, and organizes it in fast pop-up fashion or slower text database fashion



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Christopher O'Malley
PERSONAL COMPUTING, April '86

PC

"Because copy protection can interfere with the ability to back up a hard disk, business-oriented users may prefer programs like TranSec's UNLOCK series."

Winn L. Rosch
PC MAGAZINE, May 27, 1986

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Jerry Prouelle, BYTE, Feb. '86
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EDITOR'S SCREEN

accordingly. And in these emergent days of hypertext, I certainly want to be able to append graphic images, digitized voice, and spreadsheets to specific references in the database.

I also want it to have an intelligent (and potentially redundant) archiving and de-archiving capability. For instance, I want to take my existing database and purge anything that it or I have tagged "1986" and

■ The state of the art in voice recognition today is hardly better than it was 10 years ago.

copy it to a storage device. But I may decide to keep "Trade Show Contacts" active indefinitely. I expect the software to know and resolve the differences. And if I restore "1986" to my active database, I don't want duplicates popping up.

This magnificent knowledge base must have an open, unending structuring and linking capability, perhaps even to external databases. It should be able to tell me, "That information isn't here right now. Shall I get it?" I wouldn't be particular about where it had to go or what it had to do to get the information.

AL, GO HOME In order for the machine to be a truly personal computer, it needs to be multimodal, in a way that integrated software to date has only hinted at. I want it to shift seamlessly from word processing to calculation to database lookups to communication, as the job at hand requires. But don't think for a moment that this should be some tricked up, superfast simulacrum. I don't want a Turing machine. I don't want it to try and convince me that it's human. Rather, I want it to keep showing that it isn't human. I don't consider Max Headroom to be entertainment; why should I put up with stuff like that in my work?

Three years ago I gave a speech entitled, "The Personal Computer: When Will the First One Arrive?" I'm still waiting. ☐

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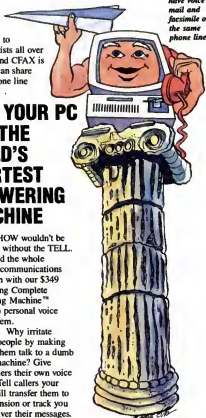
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■ JOHN C. DVORAK

CD-ROM NOW!

Surprise! Seymour and Dvorak agree on something. Not completely, of course. Dvorak has far less faith in CD developers than Seymour does.



It's been more than two years since the CD-ROM was perfected as a read-only storage device. In that same time most of the creative types in the business have written it off as ahead of its time, or "only good for specialized applications." Those specialized applications include use as a parts catalog for repair shops or an off-line medium for databases such as the Official Airline Guide. Come on, let's get creative!

Critics say there is little else the thing can do. I think I may have said this myself, largely because during introduction of these devices, which can hold about 600 megabytes of data, I was shown one encyclopedia after another as if that was all they were good for. To be honest about it, I don't use a hardcover encyclopedia; why would I use a CD-ROM encyclopedia?

At the other end of the spectrum we see a couple of expensive specialty databases on CD-ROM, with resultant minimal demand and consequent high prices for hardware, creating a vicious cycle of neglect. The only product with some chance of success is *Microsoft Bookshelf*, the Microsoft library of goodies for writers (First Looks, Volume 6 Number 18, page 33).

People have to adjust their thinking and the ideas for CD-ROM products will flow. I can think of a few CD-ROM disks I would buy and use. I'd love to see a complete listing of every movie ever made with a synopsis and a review included. Those huge printed guides to TV movies are best sellers, but none are complete and none can do any fancy cross-referencing. With a CD-ROM version I can list all the Bogart movies, for example. Everyone with a

VCR would find this product to be a killer, especially at \$29.95!

Ever heard of *Cliff Notes*? College kids buy them so they don't have to read books or so they can see what the party line is concerning the plot and theme of a famous novel. If all the *Cliff Notes* were on a CD and sold for the price of about six *Cliff Notes* booklets, every college kid would buy a copy. This is especially true when one realizes that the *Cliff* analysis can be loaded into a word processor and edited. Wink, wink!

I can imagine other instant winners for CD-ROM. How many of you would buy a CD-ROM containing every lyric of every song published between 1960 and 1970? "From K-Tel! Every lyric of every song, Volume 1. That's right: every song, every favorite. Order by phone. Not available in stores." Hot stuff. People will collect stuff like this. Every Beatles lyric would be hot. Every "Star Trek" script. Stuff like that.



There are practical ways to disseminate other intellectual property too. If every play script were on CD-ROM and the disk were sold to schools on a royalty basis (as they now sell individual scripts), it would allow the schools to choose a play to be performed and make their own printout on laser for the actors as they pleased. No more hassles.

One popular form of publishing is songbooks containing sheet music for barroom piano players. A comprehensive CD-ROM with every song imaginable could be made. The musician picks a few from a list and they get printed out for him.

Back to the mass market. How about a complete caloric guide? A CD-ROM with a listing for every possible food, from a single dandelion leaf to a McDonald's fried chicken ball? A program on the disk helps you plan meals. Data could be stored on a floppy, and running totals for the fanatical dieter could be easily maintained.

This is another consideration. There is no reason that the CD-ROM cannot use a data file on a floppy or hard disk for its necessary read-write workspace. The combo idea, whereby the program and massive data files are on CD-ROM and the personal and update files are on floppy, is an excellent alternative to expensive formats such as WORM or read-write laser media. *Microsoft Bookshelf* does some of this.

Of course, when we dream up ideas we realize that it's not lack of ideas that hold up this technology. You can see how easily they flow. It's the artificially high prices set for the drives. Let's get them to \$200 where they belong and see what happens.



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■ JOHN C. DVORAK

INSIDE TRACK

*Secret chip emerges . . . PostScript enters adolescence
. . . Compaq shows off, scares dog.*

The battle for control of the microprocessor world heats up with news about the **top-secret P9 chip** or the **80388** from Intel. This is the 80286-pin-compatible chip that Intel hopes will become the substitute for the 80286 in 16-bit microcomputers. It has the architecture of the 80386 and the I/O of the 80286, meaning that designers of 80286 micros can switch to this chip and get increased performance, if for no other reason than that the chip should eventually be able to perform its stunts at 16 to 24 MHz.

The reason for this chip's development is to further **thwart Intel's one-time technology trading partner AMD** (Advanced Micro Devices). AMD has been able to produce, under license, a 16-MHz 80286, while Intel has not. Meanwhile, the companies are in litigation over cross-licensing the 80386. What better way to **sink the AMD boat** than by producing an 80388 that has all the advantages of the 80386 (including the speed) and none of the disadvantages of the 80286? If they were priced the same, which chip would you buy?

Kiss the 80286 goodbye if this plan works. Nobody ever liked the chip and no important software to date has been written for it. IBM can switch to the 80388 for all its ATs and never skip a beat. The old systems could eventually be upgraded if necessary. But since OS/2 is written to run on the 80286, IBM can let it die a **natural death**. It will go the way of the old 8080. The 8080 was simply swallowed up in a deluge of cheap Z-80s years ago. People give you a quizical look nowadays when you mention the 8080.

The big issue to me in all this is still second-sourcing (see *Inside Track*, Volume 6 Number 19, for a **complete diatribe** on this issue). Second-sourcing means making the chip available (under license) from other vendors. Forget it with these chips. Don't expect other vendors to sell the 80388 or the 80386. Intel won't license them. I'd sure **hate** to hitch my cart to a set of **one-eyed ponies** owned by a fickle friend whose girl doesn't like me.

Quick Tip Dept.: Are you into typesetting and PostScript, bumpy? Note these words: **Not all PostScripts are alike**. Adobe is a PostScript supplier. Adobe is a font supplier. The Adobe PostScript runs Adobe fonts, which are similar but not totally compatible with plain-vanilla PostScript fonts. Adobe PostScript also runs plain-vanilla PostScript fonts. **Phoenix** is a PostScript supplier. Phoenix made a deal with **Bitstream** and the Phoenix PostScript runs Bitstream fonts, which are similar but not totally compatible with plain-vanilla PostScript fonts. Phoenix PostScript also runs plain-vanilla PostScript fonts. Adobe PostScript will not run Bitstream fonts and Phoenix PostScript will not run Adobe fonts. This regardless of the fact that both systems are called PostScript.

Time out! The above scenario will get worse before it gets better. Question I asked of a Phoenix exec and now I ask of all potential PostScript suppliers: will you supply a utility to turn your proprietary fonts into plain-vanilla PostScript so I can use them on any old PostScript printer? Response: "Hmmm, never thought of it. Good idea."

The reason for all this confusion? It's

simple—plain-vanilla **PostScript simply doesn't do the job it's supposed to do**: reduce and enlarge typefaces from a single outline. Come on—somebody should be able to do this right.

Hot New Products Dept.: By the time you read this, expect to see the **IBM PS/2 Model 55 80286-based portable laptop** on the market, as well as the **Toshiba 5100** and perhaps a few other real portables. Last month I went to see the newest Compaq portable—the **80386-based lunch bucket**. It was released along with a 20-MHz 80386 screamer. While the head of strategic marketing at Compaq seemed like a cool character at the rollout, the rest of the Compaqs seemed a bit stiff. I don't want to be judgmental, but Compaq has the **dullest bunch of buzzards** working there that I've ever met. Please, no offense. But it's as though they took the worst traits of IBM-land and transposed them to Houston. Loosen up, guys. I couldn't even get the product manager of the 20-MHz 80386 screamer to admit he had a hot machine. "I like to think of it as an addition to a full line of Compaq machines," he said, stonewalled.

While the idea of cloning the IBM mentality and demeanor of yore may have its proponents, I'm not one of them. After all, it's 1987, and we don't need money and haughty reserve anymore. Ever heard of **sincerity** as a tack?

My response to the peculiar Compaq uptight arrogance is simple: Have you guys **ever looked at one of your machines?** Egad. My recommendation: Fire one of those humorless employees and hire someone with design skills. Even Atari has a designer. I don't mind having the world's fastest micro, **but not if the sight of it scares the dog!** Repeat after me: "It's 1987 . . . it's 1987 . . . it's 1987."

It's almost 1988, for gosh sakes! Check the calendar.

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DB Graphics turns raw dBASE III/III PLUS and R:BASE data files into graphics with no conversion, export or import.

Up until now, turning the raw data of a dBASE III/III PLUS or R:BASE file into easily understood graphs and charts has been anything but quick.

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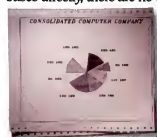
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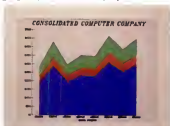
You can change the style of a graphic, or the data it represents in an instant.

to precisely select and graphically display the data you need. And because it has a direct line to your live data, you can modify a graph, or choose different data to represent, in an instant.

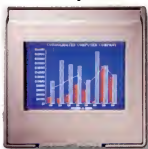
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■ JIM SEYMOUR

CD-ROMS: WHO'S BEEN SLEEPING?

Just when we were ready to give up on compact disks as a practical medium for low-cost, large-volume data retrieval, the giant began to stir.

Often, when we've grown weary of overpromised and underdelivered technological miracles, we tune out on what's happening in a field, relegating it to that graveyard of good ideas that got hyped into oblivion.

Then once we're no longer paying attention, that field blooms and starts fulfilling its promise. The tree falls in the forest, but... I suspect that's what's happening now with CD-ROMs, optical disks the size of compact digital audio disks but capable of storing 500 megabytes of data, instead of 50 minutes of punk rock.

For 4 years now, pundits (present company included) have been proclaiming the wonders of the CD-ROM. It can bring a whole shelfful of reference works to your desktop, give even the most fanatical securities analyst more data than he can digest. You remember those stories: "the sleeping giant... about to awaken?"

Unfortunately, it was hard to go down to the corner computer store and actually buy a CD-ROM disk—or, for that matter, a CD-ROM player. CD-ROM remained a myth for most PC users, even those who had some idea that 500 megabytes sitting on their desk was just what they wanted. It still is.

Part of the problem has been the economics of the CD audio-disk-player market. The Japanese digital-disk-player makers saw demand for their audio versions explode. If they couldn't meet that demand, why disrupt production, big margins, and big profits to convert a line or two to making CD data disk players? So the \$250 to \$300 CD player—realizable in

technical and marketing terms today, without any breakthroughs and without, in fact, much effort—has been delayed.

There's also this little problem of what to play on CD-ROM devices: Where do you buy CD-ROM disks? That's where we've been asleep while the CD-ROM industry was coming to life.

LOTUS WAKES UP Lotus, for example, wants to be a major player in the CD-ROM business. (Or actually, in the information-publishing business, which is a much smarter business plan: CD-ROM disks happen to be the preferred delivery mechanism for that information.) So Lotus began a start-up, OneSource, built in part around an acquisition, Isys; bought Bluefish, for superior CD-ROM indexing technology; bought Datext, an established publisher of corporate financial data on CD-ROMs, for instant market share.

Listen closely: Over the next 12

months, Lotus will be publishing a trillion and a half pages of financial data on CD-ROMs. That's right: trillion, with a "t." That will be spread through 52 weekly releases of Lotus OneSource, 48 releases of Datext's CD Corporate series, and about 40 Datext vertical-market editions.

That's not pie-in-the-sky, coming-someday stuff, but commitments Lotus has already made to subscribers. In other words, it's cashed the checks. And it's not going to give back the money.

Still think the CD-ROM market is somnambulant?

Microsoft, also committed to becoming a force in CD-ROM publishing, shipped *Bookshelf* in September (see First Looks, page 33, *PC Magazine*, Volume 6 Number 18) and has begun a bundling promotion with Amdek, whose CD-ROM player is starting to show up in computer stores.

Bookshelf is a fascinating product, for it shows both the strengths and weaknesses of the state of the CD-ROM art. It combines *The American Heritage Dictionary*, *Roget's Thesaurus*, the current *World Almanac*, *Bartlett's Familiar Quotations*, *The Chicago Manual of Style*, a spelling checker and usage checker from Houghton Mifflin, a U.S. ZIP code directory, and a directory of businesses and government agencies.

Microsoft has also tacked some self-serving promotional sludge onto the disk: a "DOS Sampler" and a wildly irrelevant Word tutorial.

Good integration with eight popular PC word processors makes it easy to go out to *Bookshelf*, check something, then cut and



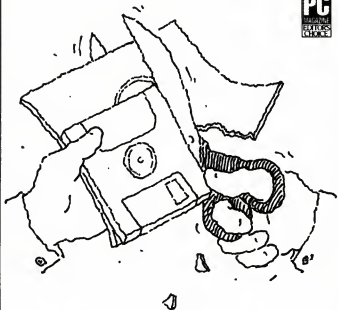
■ JIM SEYMOUR

paste the information into your document.

The quality and usefulness of the reference tools in *Bookshelf* vary greatly. The dictionary is superb. The thesaurus isn't up to Microlytics' *Word Finder* thesaurus,

supplied with several WP programs. The *World Almanac* is interesting but not very useful (except to term-paper writers, who will love *Bookshelf's* ability to cut text from a reference work and paste it into

your own). The Business Forms & Letters module represents canned writing (and thinking) at its homogenized worst. The ZIP code directory is *wonderful*; easy to use and tough to fool. And so on.



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OVERALL WINNER This kind of unevenness will be common in the world of CD-ROMs—and highly individualistic: there will be *Bookshelf* customers who'll love its canned business letters. And despite my skepticism about parts of *Bookshelf*, make no mistake about my overall reaction: I love it. I use it.

Bookshelf also points up one of the frustrations of using CD-ROMs: search terms are slooooooow, often several seconds. The Microsoft people like to point out that *Bookshelf* is a lot faster than getting up,

■ What do you play on CD-ROM devices? That's where we've been asleep while the CD-ROM industry was coming to life.

walking across the room, finding the right book (assuming you have it), taking it down, and looking up an entry. Sure, but c'mon: this is the computer age; we shouldn't have to fall back on print-era analogies to make electronic reference tools palatable.

Most interesting of all is the commitment of the two largest PC software publishers to this market. And the immediate usefulness of their current releases.

The CD-ROM market needs nothing so much right now as critical mass: enough good and useful titles out there to persuade buyers it's worth ponying up for a CD-ROM player and surrendering an expansion slot in their PCs for the interface card.

And, maybe, a little attention from a lot of us who've become jaded about CD-ROMs. The giant has awakened.

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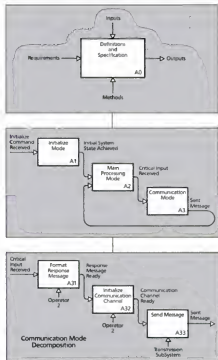
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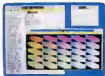
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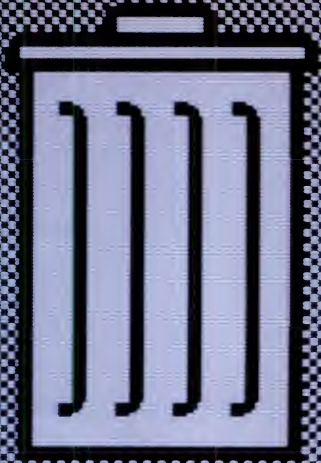
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■ STEPHEN MANES

CONFUSION '88: YOU'RE NOT ALONE



Industry bigwigs seem to congregate in balmy climes every other week. Now, thanks to your intrepid columnist, there's a conference for the rest of us.

Dear PC Industry Outsider: Doesn't it make your blood boil to read about all those incredibly expensive and supposedly exclusive "insiders' conferences," in which high-level industry honchos schmooze and preen and nibble songbird pâté and spend quarter-hours at a time congratulating each other and making outlandish predictions in panel discussions that cleverly maintain the tax-deductibility of vacations in luxurious tropical resorts boasting hot and cold running ewe's milk?

Me, too. That's why I am about to do something outrageous. I am going to ask you to fork over \$19.87 (plus tax) to attend a conference guaranteed to include no celebrities, futurists, chief executives, industry pioneers, venture capitalists, product evangelists, or marketing geniuses whatsoever. I call it ConFusion '88. You'll call it time and money well spent.

ConFusion '88 is the only computer conference explicitly intended to be of, by, and for Industry Outsiders: people who actually have to get things done with the computers they've got, not people who are trying to sell more of them. Instead of rosy visions of a future glimpsed through carefully leaked and wildly optimistic product announcements, ConFusion '88 will address the here and now: the chaotic disorder in the existing world of computers we real users actually have to put up with.

NO PLATITUDES Forget the usual platitudes of silver-tongued industry fat cats who can summon ten technicians at the first sign of a paper jam. Lowe? We

won't even let him say hi. Sculley? We'll hand him a Coke and send him packing. Bill? We'll show him the gates. Philippe? We won't be lured by sax appeal. Mitch? Hey, our protection won't be cracked.

And we've gone further in our commitment to you, the Industry Outsider. We've outlawed the navel-gazing, eyeball-glazing sessions you find at every other computer gathering. We guarantee you'll have to go elsewhere to sleep through the following:

- Tomorrow's Operating Systems: Bold Visions for the Future
- Micro-Mainframe Links: Gateways to the Future
- Artificial Intelligence: Smart Opportunities for the Future
- Desktop Publishing: Gutenberg of the Future
- Optical Storage: A Limitless Future
- Why We're So Wonderful: Industry Insiders Flatter Each Other



Nope, none of that goody-goody kissy-face stuff for us. At ConFusion '88 you'll meet and mingle with people in the trenches: Industry Outsiders just like you. By-passing the soporific "panel session" format and narcotic speeches by industry dullards, ConFusion '88 will rely on exciting presentations by unsung user-heroes before audiences armed with overripe tomatoes. Take a look at just a few of the sessions on our agenda:

MY DEALER DONE ME WRONG: TALES FROM THE DARK SIDE

Dirty laundry goes through the spin cycle as we take on dealer practices rarely mentioned in polite company. You'll shed a tear at the sad tale we call "Nobody Told Me It Wasn't an Official IBM Hard Disk." You'll cluck with sympathetic understanding at the saga known as "CONFIG.SYS? What's That?" and its successor, "IBM's PS/2 Disk Cache? Never Heard of It!" You'll roar with laughter at the punch line, "We not only install it, we service it, too!" There'll be plenty of time for audience participation. We bet you'll have a story or three of your own!

HOW YOU GONNA KEEP 'EM DOWN ON THE DOS AFTER THEY'VE SEEN THE MAC?

When the graphics department of a mid-size construction company brought its first Macintosh into an all-PC shop, the secretarial pool claimed it was getting second-class treatment. W. J. "Jerry" Riggs explains how he kept the grumbling from turning into a full-scale revolt.

■ STEPHEN MANES

DOWN IN FRONT!

"I did it, and so can you!" says intrepid design guru Yogi Bobjoy. Just returned from a 2-month retreat, during which he finally managed to get his downloaded

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WHAT'S YOUR NET WORTH?

Installing a local area network invariably means headaches. Hyman "Bud" Wiser of Bud's Gun Shop discusses highly effective ways of keeping the headaches out of your cranium by getting your networking consultant to deliver on his promises.

RESERVE NOW There'll be lots more, so reserve your place now (the price goes up to \$19.88 after January 1). While those high-rolling layabouts are sunning themselves at hotsy-totsy spas, you'll be seeing the northern lights of friendly Fairbanks, Alaska, January 19 through 21. The Motel 22.50 has reserved a block of "suites" complete with cracked integral plastic shower, TV theft-prevention devices, and sanitized toilet seats. There are no phones in the rooms, but a nearby booth accommodates data transmission at 110 baud. That'll help make your stay a pleasure.

The fat cats play tennis and golf. The Steve Manes Shot-and-Beer Noncelebrity Bowling Tourney will take place the day before the conference. We'll enjoy the fun of using nonartificial intelligence to cajole barrel-chested lumberjacks and pipeliners into sharing their lanes. Should be a hoot!

And though evening entertainment isn't exactly plentiful, we'll keep the spirit going with a nightly trivia and troubleshooting contest. Hone up your cable-making skills for our Interfacing Tournament. Get out your pica ruler for the exciting Font-Off. Memorize those endless escape codes for Laser Tag. And prepare for our riotous Diagnostics Duke-Out: we'll be handing out machines and cards with randomly scrambled DIP switches and error-plagued manuals; the Fairbanks Fire Department will be on hand for the fun.

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EDITOR'S CHOICE

1985-1987

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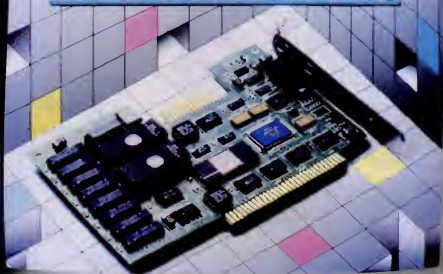
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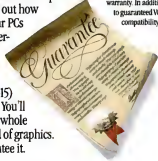
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UPWARDLY MOBILE CADD

Just 4 years ago, computer-aided design and drafting (CADD) systems cost \$110,000 per workstation. And companies that could afford such systems bought them because they quickly paid for themselves. Then in 1982 *AutoCAD*, *CADplan*, and several other packages for microcomputers appeared, effectively stunning the engineering and architectural worlds. Could programs costing only \$1,500 to \$3,000, running on \$4,000 computers, do the work of \$50,000 packages running on \$50,000 computers? Not when they first appeared. But eventually they did, and now vendors of large CADD systems are hard pressed to explain to prospects why they should buy anything more expensive than *AutoCAD* on an AT with a 19-inch monitor.

Can CADD packages that cost less than \$500 keep up with the *AutoCAD*s—the high-end, feature-rich standards of the industry priced at up to \$3,000? Do you need such features for your application? For the 17 packages that we review here, the answer is . . . yes and maybe.

Now, a new generation of CADD vendors claims that you can configure an entire CAD system and obtain capabilities similar to *AutoCAD*'s for less than \$3,000, with software costing less than \$500 and hardware—including output devices—for under \$2,500. These systems have en-

countered the same skepticism that first greeted *AutoCAD* and its fellows 5 years ago—only many of the current skeptics are the ones who flaunted *AutoCAD* (which has now become a de facto standard in the industry) in the face of the "old line" CADD users.

To test the new generation's claims, PC Labs designed performance tests that would stretch the speed and capabilities even of *AutoCAD*, then tested and reviewed *AutoCAD* as a benchmark. Our reviewers then used the same performance tests for the 16 other packages, all of which cost less than \$500, to see how they measured up or fell short.

Besides *AutoCAD*, the packages reviewed here are Autodesk's *AutoSketch*, Micro Control Systems' *Cadkey 1*, Complete Computer Services' *CCS Designer*, West Coast Consultants' *Curve Digitizer*, Foresight Resources Corp.'s *Drafix 1 Plus* and *Drafix 3D Modeler*, Evolution Computing's *EasyCAD*, Pelton Engineering's *ECAD Drafting Software*, Entek Scientific Corp.'s *EntekCAD*, Generic Software's

■ LOW-COST CADD

Generic CADD, Micrograph's *In*a*Vision*, DSL's *LaserCAD*, MATC CAD's *MATC CAD*, American Small Business Computers' *ProDesign II*, Enabling Technologies' *Pro3D/PC*, and MSA Group's *TurboCAD*. *Generic 3D*, from Generic Software, which also meets our under-\$500 selection criterion was unavailable at the time of testing.

IS IT DESIGN? What will not vary with price is the nature of CADD itself. Allowing for individual differences, all CADD software packages—from the most expensive ones running on dedicated workstations to those selling for under \$100—do the same thing. We spell CADD with two *D*s because although design and drafting are certainly different activities—and although CADD vendors claim to address either or both—the difference between them is sometimes blurred.

Design requires conceptualization, while drafting needs good hand/eye coordination and familiarity with drafting tools—compass, straightedge, drafting pens, and so on. Despite manufacturers' claims, CADD can't help you design, but it can help you draft. Even without good hand/eye coordination, you can produce exquisite drawings with CADD packages. CADD has eliminated the profession of drafting and replaced it with the skill of CADD system operation.

Because CADD packages do not help you conceptualize a drawing, they will not speed up the initial design process. Like writing, however, designing entails a great deal of editing, and CADD packages speed the editing process considerably. A drawing might undergo 50 to 100 changes; using a CADD package might make those changes go 10 to 50 times faster.

A BARRAGE OF TESTS Our tests, therefore, examine the drafting capabilities of each package. We performance-tested the packages reviewed here against *AutoCAD* because it is the de facto standard in the CAD industry. *AutoCAD*'s status comes not only from its tremendous number of features and the depth of capability within each one, but also from its macro capabilities and AutoLISP programming language (not to mention Autodesk's marketing expertise and timing).

The programming features have enabled users to customize their own applications and have made it possible for hundreds of third-party vendors to create over 400 add-on packages for specialty applications, including symbol libraries, custom tablet menus, NC programming systems, parametric design programs, structural analysis suites, animation codes, and more; Autodesk publishes an inch-thick catalog of them. With the help of these third-party add-ons, *AutoCAD*'s base has grown to 100,000 installations—or nearly half of all CADD users. For any package under \$500, then, trying to challenge *AutoCAD* is a tall order.

Each of the programs reviewed in this article was tested by an experienced CADD user who was required to become

familiar with the program and its documentation. The drawing tests had the reviewers create a simple architectural drawing and a rendering of a gear, then modify these drawings by stretching and changing their dimensions.

PC Labs also included a 3-D model for testing packages with 3-D capabilities. Reviewers also ran file import tests to translate a firehose nozzle drawing into and out of DXF and IGES file formats and noted any changes in the files. Other tests timed the common CADD tasks of redrawing a screen and deleting a portion of it.

Since this procedure required the reviewers to examine the whole range of CADD capabilities, from the simplest to the most complex, it enabled them to judge each package's appropriateness for every

OUR REVIEWERS

Steven Foster, an independent CADD consultant, has over 14 years' experience working with mainframe, mini, supermini, and micro-based CADD systems. He teaches computer-aided design courses at the University of Tennessee College of Engineering, and has authored a number of papers on computer-aided facilities management.

Mitzi Fox has worked in the consulting engineering and retail computer business fields. She is currently senior product manager for CADD graphics and desktop publishing at the headquarters for Entre Computer Centers in McClean, Virginia.

W. Bradley Holtz is the founder of WBH Associates in Bethesda, Maryland. He is a registered architect, offering consulting services in CADD systems, scanning, and management, and is a frequent speaker at industry seminars and workshops.

David Jordani is president of David Jordani Associates, a Minneapolis-based consulting firm helping architects, engineers, facilities managers, and product manufacturers select and implement CADD facilities management systems.

Joel N. Orr, a CADD/CAM and computer graphics consultant, holds a Ph.D. in mathematics and computer science.

He is chairman of Orr Associates Inc., a consulting firm located in Great Falls, Virginia. He is also a founding member and president elect of the National Computer Graphics Association and director of the CADD/CAM Institute, a seminar and publishing firm.

Donald C. Peckham is a resident engineer at Hyster Company's Berea, Kentucky, industrial lift-truck manufacturing facility.

Carlos Pinkstaff is a principal of Mentat Services, a company that provides computer-aided solutions to engineering and business problems.

Jeff Prossie is a contributing editor of *PC Magazine*.

Martin L. Ramsey is the general manager of Ceath Company, a firm that specializes in information management consultation for small businesses in the central Kentucky area.

William Taylor, an independent consultant specializing in artificial intelligence, holds a master's degree in electrical engineering from MIT.

Terry Wohlers is president of Wohlers Associates, a computer-graphics writing, training, and consulting firm located in the Denver-Fort Collins area. He is also director of the National Computer Graphics Association Board of Directors.

type of user, from the occasional planner to mechanical engineers and architects to designers requiring 3-D models.

CADD FEATURES All CADD packages use "primitives" or "entities" to create drawings. These include points, straight lines, parallel lines, rectangles, polygons, arcs and circles, ellipses, curves, and multipoint curves. Some packages also offer free-form sketching.

To place the entities on your screen, CADD packages let you specify the exact coordinates of the object using either keyboard, digitizer, or mouse; some of them also let you specify x-y coordinates relative to some other point on the display. The third way to determine location is by using polar coordinates for which you specify the length of a line and an angle.

All CADD applications require you to set the scale of the drawing, which translates the drawing's units of measure into real-world measurements. For instance, you might choose to set 1/4 inch in an architectural drawing to represent 1 foot of a real building.

To help you align your graphic elements properly, most packages offer grid and snap capabilities. A grid is usually displayed on the screen and indicates intersections at regular, specified distances. Some low-end packages don't offer grids but perform a similar function by allowing you to set a specified distance that the cursor jumps each time you press a cursor key. Snaps act like magnets, pulling the cursor to the nearest point on the grid or the endpoint of a line, the intersection of certain lines, the midpoint of a circle, to the nearest quadrant.

You move around within a CADD drawing screen by using the Zoom and Pan commands. The Zoom command increases and decreases the size of objects on the display, while the Pan command allows you to move around the screen without changing the size of objects. A Drag command allows you to move objects around the screen.

CADD packages generally include commands for editing drawings. Just as you mark blocks of text in a word processor before moving or editing them, you select groups of objects for some editing operations in a CADD package. A simple

selection method is to draw a box around an area on the screen; the package will perform the specified operation on everything in that area. In a crowded drawing, however, you may not wish to perform an operation on everything in a window. You may wish to exclude bits of adjoining objects or even entire objects. Some packages, such as AutoCAD, have highly flexible object selection criteria that allow you to include or exclude objects resting partially within the window, or to include and exclude various types of objects.

Some CADD editing commands such

■ Even without good hand/eye coordination, you can produce exquisite drawings using a CADD package.

as Move, Copy, or Delete are similar to ones you'd find in any package. Many programs also offer an Undo command; the better ones even let you unerase the last erasure or undo the last command.

You'll also find a number of CADD-specific editing commands. Many packages allow you to rotate objects, resize them, fill them with a color or hatching pattern, join two endpoints, and use Trim and Extend commands to modify lines so they intersect neatly with other lines.

Editing features that were particularly useful for the PC Labs gear-drawing test included a fillet function for creating smooth curves between the arcs that made up the gear tooth in the drawing. A mirror function enables you to construct only half of the tooth, then reflect that half over a center axis to construct the remainder. A circular array function makes quick work of the rest of the gear by copying the tooth in a radial pattern. A package that does not offer these features would be inadequate for mechanical drawing.

For the architectural test drawing, we found that parallel-line commands and intersection cleanup features were especially

helpful in rendering walls, though many packages don't offer these features.

Many CADD packages allow you to structure your drawing by layers, as if you were drawing with acetate overlays. For instance, an architect might use one layer for the basic floor plan, another for dimensions, a third for the electrical plan, a fourth for the plumbing, and so on.

Most drawings require the CADD package to have some dimensioning capabilities. Dimensions are annotations made on drawings to indicate line lengths and angles. Packages should allow you to place dimension lines parallel to the lines they describe, whether those lines run horizontally, vertically, or at an angle. You should also be able to dimension the diameter and radius of a circle. Packages that offer tolerancing capabilities allow you to specify a margin of error on a drawing.

The better packages calculate dimensions for you automatically; very low-end packages require you to figure them out yourself. Programs that offer associative dimensioning will automatically change dimensions as you edit or change your drawing.

Different professions and firms use different conventions for indicating the termination of the dimension lines, such as arrowheads, tick marks, or circles. The package should therefore offer a variety of dimension line terminators or allow you to define your own.

CADD programs allow you to store symbols or images on disk and insert them into other drawings. An architect, for instance, might define appropriately shaped symbols for appliances, windows, doors, and so forth. A good CADD package will allow you to rotate and scale symbols for placement in a drawing.

Some of the packages offer an optional bill of materials module that can act as a database for various labeled components of your drawing; you can use the database to form lists of parts or components. This feature would help a variety of professionals such as architects, builders, or even plumbers and electricians to create tallies of needed parts or materials.

The most sophisticated design and drafting packages, such as AutoCAD, offer macros and programming languages that allow you to alter menus, create your own

■ LOW-COST CADD

commands, and speed up your use of the program.

Many architects—and most mechanical designers—are used to designing in two dimensions; most of the products we reviewed are drafting-board replacements for two-dimensional design. Although three-dimensional design has been around for more than 20 years, it is still in its infancy. Those who work with 3-D agree on the need for geometric representations that behave like real 3-D objects. In CADD terms, such users eschew wireframe and surface models for solids.

Wireframe and surface models don't show the complete topology of an object. But solid models are not easy to understand in their present form and require more processing power than the current generation of PCs offers for practical use. At least one 3-D wireframe product in the near-\$3,000 range—*Cadkey*—has attained some success in the market. But you need considerable skill and knowledge to use the package effectively.

The simple 3-D systems reviewed in this issue—*Drafix 3D Modeler*, *Cadkey 1* and *Pro3D/PC*—are not production tools, but they can be useful for learning the possibilities inherent in 3-D.

To share files between packages, two file standards are available: *AutoCAD*'s DXF is widely accepted as a data exchange format and the far more cumbersome but ANSI-approved IGES (initial graphics exchange specification) is also functional. Both of these formats are actually ASCII files that knowledgeable users can edit with a word processor. If you are selecting a system for serious production work, experiment with the ones that support at least one of these formats so that you'll be able to salvage your drawings if you decide you don't like the product.

TIMING TESTS Because some packages redraw the screen whenever you move or modify an entity, timing these functions is particularly important. Similarly, deleting a file is a common function that shouldn't cause unnecessary delay. We also looked at how much memory each product used to store the same drawing. File sizes vary because programs use various compression algorithms for data storage. All tests were performed under the

uniform testing conditions of PC Labs. All were performed on the same system—an 8-MHz IBM PC AT with an 80287 math coprocessor and a 30-megabyte hard disk, plus an EGA monitor with 256K of video RAM.

STANDING UP TO THE STANDARD

In general, these under-\$500 packages are much less flexible than *AutoCAD* or more-expensive products. While all of them can draw lines and circles, only a few offer more than three ways to perform either

■ Many inexpensive CADD programs give you enough functionality to get almost any job done—and fewer capabilities means easier use.

function. And none has a programming language comparable to *AutoLISP* (though the one offered by *EasyCAD* comes close). Several packages do give the user a complete definition of their data structure, so that a knowledgeable programmer could modify geometry files through other programs.

On the other hand, most CADD users require little of the flexibility of *AutoCAD* and other packages. Many of the inexpensive programs provide enough functionality to get almost any job done—and fewer capabilities means easier use.

While *AutoCAD*'s army of third-party software developers and add-on products is a significant benefit, some of our bargain packages sport add-ons, too. *Generic CADD* has drafting enhancements and symbol libraries; *Drafix 1 Plus* offers translators and symbol libraries; and there will soon be others.

So which package is best for your job? If you are drafting in a professional environment, don't let price differences guide your selection. The cost difference between an adequate \$500 package and an al-

most-adequate \$100 program is probably inconsequential compared with the relative benefits of the products. On the other hand, the fact that one program costs more than another does not mean it is in any way superior.

As we report in the reviews, the availability of certain features will make some packages better suited to different applications. For example, mechanical engineers will need a full range of features for defining curves, which includes centers, radii, diameters, and various specification points; fillet, mirror, and circular array features; and spline and Bezier curves, as well as snap commands for circles. A professional architect, however, will want a wide variety of line commands—particularly parallel lines—and a variety of text commands for creating attractive labels. The nonprofessional user might simply want a simple, easy-to-use system such as *AutoSketch* or *EasyCAD* for sketching plans for offices and homes.

HARDWARE Like desktop publishing, some CADD applications may require you to purchase an entire system rather than simply a software package that runs on your existing hardware. Though your present system may be adequate for your needs as a casual user, if you want to use CADD for production drafting you will probably need to build up your workstation. For heavy-duty CADD applications, you should have a PC with at least 512K RAM and a math coprocessor, a hard disk, a mouse, and an EGA board with matching monitor. Panning and zooming, which repaint the display, are significantly speeded up by the math coprocessor, which performs some of the calculations required for these operations.

A large display can be very helpful in dealing with large drawings. Allow \$2,000 to \$4,000 for a 19-inch-diagonal unit; a matching graphics card will run anywhere from \$400 to \$2,500.

CADD files can be quite large, ranging from about 15K bytes for simple drawings to over 100K for complex ones. That, together with the fact that some CADD programs have lots of layers, is why you need a hard disk.

You can enter data into these packages using either the keyboard, a mouse, or a

digitizer. The keyboard is best for entering coordinates for points and making selections from a menu; the mouse and digitizing tablets are for screen drawing. Many CADD users prefer digitizing tablets because of their similarity to traditional drafting tools. Drafting tablets consist of a flat surface, analogous to the drafting or drawing pad, and use some sort of pointing device analogous to a drafting pen or drawing pencil to translate the movement of your hand into a digitized form that the software can use.

Digitizer tablets, which range in price from \$150 to \$1,500, are more expensive than mice, which typically cost between \$100 and \$200. Digitizers usually offer higher resolution than a mouse's 200 dots per inch. And digitizers also do more than simply control the screen cursor. You can trace documents on them, and you can purchase menu templates for certain programs that will obviate the need for on-screen menus, giving your screen more room to display your drawing. The Pencil Pen-pad Model 320, for instance, comes with templates for *AutoCAD*, *Cadkey*, *Cadventure*, *Freelance*, and *VersaCAD*; the Kurta IS/ONE Series Tablet comes with templates for *Microsoft Windows* and *AutoCAD*. The surfaces of both of these tablets are also fully programmable. (For more information on tablets, see "Tablets for Precision Graphics," *PC Magazine*, Volume 6 Number 14.) I prefer a mouse, because it lets me keep my eyes on the screen. But experiments by the U.S. Army indicate that there is no inherent productivity benefit to any particular device (key-note address by Dr. Robert Anderson, The Rand Corporation, at Harvard Computer Graphics Week, Cambridge, Mass., Summer 1981).

Pen plotters produce lovely output but can be very expensive. Nor can you leave them unattended for long: pens dry out unexpectedly, and paper sometimes jams. Dot matrix printers are much more convenient and less expensive, but their output is not very pretty. Ink jet and thermal transfer printer/plotters offer interesting alternatives for color output, but their paper size is usually limited to 8½ by 11 inches (except for models costing over \$8,000). There are at least two pen plotters on the market that can produce drawings up to D size (22 by



Low-Cost CADD: A Decision Guide

As you can see from the large features table for the CADD packages reviewed here, CADD programs are packed with capabilities. Yet, if you're looking for a package for a specific application such as mechanical engineering, mapping, or architecture, the presence of just a handful of features will be the deciding factor. To help you quickly locate the right package for your application, we list those critical features and the packages that offer them below.

ARCHITECTURE

- Double line intersection cleanup
- Dimensioning: feet/inches, tick-mark terminators

AutoCAD, ECAD Drafting Software

MECHANICAL ENGINEERING

- Splines ● Fillet ● Chamfer ● Hatching
- Angular dimensioning ● Tolerancing
- Rectangular and circular arrays

AutoCAD, Draftix 1 Plus, LaserCAD

ELECTRICAL ENGINEERING

- Good symbol manipulation ● 90-degree rotation ● Grid and element snap

AutoCAD, AutoSketch, Cadkey 1, Draftix 1 Plus, EasyCAD, ECAD Drafting Software, Generic CADD, LaserCAD, MATC CAD, ProDesign II, TurboCAD

CIVIL ENGINEERING/MAPPING

- Can set text on angle ● Allows relative polar-coordinate entry ● Measures distance and area ● Constructs multipoint curves

AutoCAD, AutoSketch, Draftix 1 Plus, EasyCAD, Generic CADD, LaserCAD, MATC CAD, ProDesign II

PRESENTATION GRAPHICS

- Multiple fonts ● Fill and hatching
- Text justification

AutoCAD, Draftix 1 Plus, Generic CADD, In'a'Vision, ProDesign II

CASUAL USE

- Explicit on-screen menus
- Freehand sketching

AutoCAD, AutoSketch, Cadkey 1, Draftix 1 Plus, In'a'Vision, LaserCAD, ProDesign II

34 inches) for under \$2,500. Speed, size, and convenience features escalate the prices quickly; production-quality E-size (34-by 44-inch) plotters cost from \$5,000 to \$8,000.

If you don't need large drawings, many CADD packages will output to laser printers, which are fast, convenient, and relatively trouble-free.

The top-of-the-line production output device for CADD systems is the electrostatic plotter, a raster device with a resolution of up to 500 dpi, capable of producing drawings up to 72 inches wide at a speed of 2 running inches per second. These units range from \$8,000 for monochrome 11-inch-wide models to \$90,000 for 72-inch color models. And for productive operation they require separate rasterizing hardware, which starts at \$10,000. Not for the average one-person shop, but quite reasonable for networks of multiple users.

Even without an electrostatic plotter, you may want to dedicate a PC—or at least an intelligent buffer—to plotting so that your PC is not tied up while the system is creating hard copy.

If you have existing drawings, you can scan and read them into your CADD system or have a service bureau do it for you. But this will probably cost more than redrawing them on the system. You can now purchase scanners for \$1,000 and functional though expensive programs that convert the raster-format-scanned data into vectors, including Autodesk's *CAD/camera* for \$3,000, Microtek Lab's *CADmate* for \$995, and American Small Business Computers' *ScanPro* for \$495. For \$2,995 you can purchase the Houston Instrument *Scan-CAD Accessory*, which reads line art from large originals and stores it on disk. (For more information on scanners, see "Scanners Take Off," *PC Magazine*, Volume 6 Number 17.)

But that's not enough. Your drawings have text, such as notes and dimensions, that cannot be read reliably by even the most expensive (\$500,000) systems. And even if the text could be read reliably, it would still have to be manually associated with the appropriate graphical elements. Finally, it is extremely likely that the dimensions on your drawings will not match the scaled dimensions of the lines—and how is the system to decide which is correct?



CADD Talk: An Illustrated Glossary of CADD Terminology

A SIZE Engineering drawing size: 8.5 by 11 inches. Engineering drawings also come in B, C, D, and E sizes.

AEC Architecture/engineering/construction.

ALIASING A term that comes from signal processing, a subdiscipline of electrical engineering. Used in graphics, aliasing refers to "jaggies"—the stair-like steps that make up a diagonal line on a raster display. Some displays incorporate "anti-aliasing" circuitry, which reduces the visual impact of the jaggies without increasing resolution.

Smooth



Aliasing (Jaggies)



ARRAY (Noun) An orderly arrangement of objects. (Verb) To make copies of selected geometry at the indicated distances in rows and columns, or in a radial pattern.

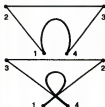
ASSOCIATIVE DIMENSIONING The process whereby a program changes some dimensions automatically to reflect changes the user has made to a dimensioned object.

ATTRIBUTES Features of a rendering under user control. They can be graphical, such as color, line type, and so forth, or nongraphical, such as part number.

B SIZE Engineering drawing size: 11 by 17 inches.

B-SPLINE A polynomial parametric function that can be joined to another B-spline. Compare "Bezier curve."

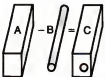
BEZIER CURVE A polynomial parametric function that is simpler but more difficult to blend than a B-spline.



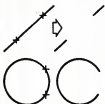
BLOCK See "symbol."

BOOLEAN EQUATIONS Applications of the set-theory operations of union, intersection, and complement to solid models.

$$A - B = C$$



BREAK To make gaps in a geometric object, usually creating new points; for example, removing an arc from a circle.



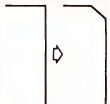
C SIZE Engineering drawing size: 17 by 22 inches.

CADD Computer-aided design and drafting.

CAE Computer-aided engineering.

CAM Computer-aided manufacturing, including numerical control (NC), robotics, and other applications of computers in the factory.

CHAMFER To join or chop two perpendicular lines with another line.



COMPONENT See "symbol."

COORDINATE PRECISION In digital computers, points in space are represented by discrete numbers. The coordinate precision is a measure of how many such points can be distinguished in a given unit of area. Sometimes precision is expressed as a linear function, as in "100 points per linear inch." In such cases, it is assumed that the areal resolution is simply the square of the linear measure. Another way of specifying coordinate precision is in programming terms, as a numeric type: 16-bit integer means that each axis can be divided into 65,536 parts (2 to the 16th power); floating point means that each axis can be divided into a very large number of parts. There are various forms of floating-point representation, all of which can express values of 100 million or larger.

The coordinate precision of a CADD program is what determines whether you can represent small objects that are found within large areas. For example, in a 16-bit integer system, if a plot of land that measured a mile on each side were represented in a drawing, the smallest object that could be represented in the same drawing would be .97 inches long. Moreover, all fractional lengths would have to be rounded to the nearest .97 inches.

Integer-based CADD systems are usually faster in their response times than floating-point systems.

CROSSHATCHING See "hatching."

D SIZE Engineering drawing size: 22 by 34 inches.

DIGITIZER An electronic board with a stylus or puck pointer; the position of the pointer is transmitted to the computer. A digitizer can be used as a function keyboard ("tablet menu"), a drawing tracer, and a cursor control device.

DIMENSIONS Annotation on drawings that indicate lengths and angles. Architects, mechanical engineers, surveyors, and others use different dimensioning standards, including differently shaped arrowheads, different units, and different standard locations.



DRAWING CADD drawings are close analogs of real drawings. They are 2-D representations of objects, accompanied by notations such as dimensions. Unlike a model, a drawing cannot be analyzed to determine the strength of the structure depicted.

DXF AutoDesk's external drawing exchange file format; widely used by other vendors.

E SIZE Engineering drawing size: 34 by 44 inches.

EXTEND To lengthen a line or an arc, either to a particular point or by a specified amount.

FEA Finite-element analysis. A powerful way of analyzing physical shares for structural, thermal, and magnetic characteristics. Objects are represented by meshes.

FEM Finite-element modeling or meshing. See "FEA."

FILLET A rounded intersection between two surfaces that is used primarily in mechanical engineering. In 2-D design, a fillet is a curve connecting lines of arcs in such a way that they are tangent to it. The counterpart in 3-D design is called a "fillet surface."



FILLING To shade an area with a color or a combination of colors.

FLOATING-POINT REPRESENTATION A way of representing a number by a pair of numerals, in which the first (or "mantissa") is multiplied by the base (usually 2 or 10) to the power of the second (or "exponent") to obtain the full number. This technique makes it possible to represent numbers larger than the maximum integer value of a single word in a computer. Thus, 743,000 in floating-point notation would be 7.43/5, or 7.43 times 10 to the fifth power.

GRID A matrix of dots or lines, with user-determined spacing, that can be used to align drawing elements visually. Snapping allows you to use grids to force alignment.

GROUP To link two entities temporarily for certain operations, such as moving or erasing. Some systems use "windows" for this purpose.

HATCHING A shading pattern made up of lines at specified spacings and angles. There are standard hatching representations for various materials, such as steel, aluminum, and so forth.

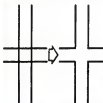


HOMOGENEOUS GEOMETRY

A way of representing geometry in CADD programming in which points, lines, surfaces, and solids share a common mathematical form, allowing a single set of manipulation routines to be used for all objects.

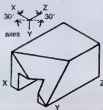
IGES Initial Graphics Exchange Specification. A neutral (nonproprietary) CADD file format defined in ANSI standard Y14.28. CADD software vendors supply translators between their formats and IGES, permitting users to move CADD files from one system to another.

INTERSECTION CLEANUP A CADD function that eliminates the superfluous lines in intersections of double-line entities.



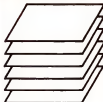
ISO International Standards Organization. "ISO dimensioning" refers to a set of drafting symbols for dimensions and rules for their placement.

ISOMETRIC VIEW A drawing of a 3-D object in which the y axis is vertical and the x and z axes make angles of 30 degrees with the horizontal. An isometric view is used because it gives a measure of realism while permitting measurement along the axes with the same scale.



JAGGIES See "aliasing."

LAYERS A way of organizing information in a digital drawing, so that different versions of the drawing can be viewed and worked on separately. You can think of the process metaphorically as overlay drafting.

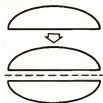


MACRO A collection of system commands that can be activated by a single code or button. Also used in some systems to refer to "symbol."

MASK To select geometry for exclusion from a subsequent operation.

MCAE Mechanical computer-aided engineering. Usually means CADD plus FEA plus solids, with additional tools for facilitating the entire design process.

MIRROR To create a reflected copy around an indicated axis.



MODEL A 3-D representation of an object within a CADD program. A model contains representations of many of the object's attributes and can therefore be analyzed—say, using FEA tools. Contrast with "drawing."

MRP Manufacturing requirements planning. A computer-based method for determining material purchasing needs, based on orders and bills of materials.

NC Numerical control. The control of machine tools through computers.

NURB Non-uniform rational B-splines. A type of homogeneous geometry constrained to ensure continuity between objects. Several large CADD system vendors have announced plans to use this representation.

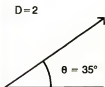
ORTHOGONAL VIEW A drawing in which a face of the object is parallel to the drawing plane, and the projection lines are perpendicular (orthogonal) to the plane of the drawing. A six-view orthographic projection is a standard mechanical drafting representation that provides views of the front, rear, left, right, top, and bottom of the object.

PAN To view a different part of the image without changing magnification.

PIXEL Picture element; also called *pel*. The smallest resolvable unit on a raster display.

PLOTTER A graphical computer output device. Examples: pen plotters, electrostatic plotters, dot matrix impact printer/plotters.

POLAR COORDINATES A way of specifying location by means of angles and distances (angles and "bearings," in civil-engineering terms).



POLYLINE A geometric entity consisting of a number of connected lines.



(continues)



CADD Talk: An Illustrated Glossary of CADD Terminology (continued)

PRECISION The number of points in the coordinate space, or along each of the axes. This value determines how small an object can be represented in a given CADD system. See "coordinate precision."

RASTER A way of representing pictures in digital form. The picture is subdivided into "tiles," like the pieces of a mosaic. A numerical value is stored in the computer memory for each "tile," indicating its color. All PCs have raster displays. Contrast with "vector."

RELATIVE AND ABSOLUTE POSITIONING When keying in locational coordinates, absolute coordinates are numbered from the origin, while relative coordinates are numbered from elsewhere—usually from the last point entered. "Place a point at $x = 10, y = 12$ " is an instruction given in absolute coordinates; "place a point at a location 10 feet to the right and 12 feet up from the present point" is given in relative coordinates.

RESOLUTION The number of pixels per unit of area or length, on a display or in a raster file; the number of addressable points per unit of area or length in a vector file.

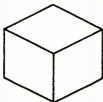
SCALE The numerical relationship between the dimensions of the image and the world. For example, architects often draw at a scale of $\frac{1}{4}$ inch = 1 foot. In CADD systems, it is usually possible to draw in "real-world" dimensions; scaling is handled dynamically by the program and is transparent to the user.

SCANNER An automatic drawing input device. Most scanners are only partly automatic because their support software recognizes only lines—not arcs, curves, or text. Scanners yield raster data; software is needed to convert the data into vectors, which is the format required by CADD systems.

SELECT Single out, usually with visual indication, for some operation.

SNAP Snaps are like point placement magnets. A CADD user might want to snap a point to the end of a line, to a midpoint, or to the intersection of two lines, for example. Systems that have snaps usually allow the user to set the snapping range.

SOLID MODELING Also called *volumetric modeling* and *geometric modeling*. Of the three main forms of computer-based geometry—wireframe, surface, and solid—solids are the least abstract and hence the most realistic. But they are also the most processor-intensive; interactive solid-modeling systems are therefore very expensive. Only solids allow you to check interference and accurately analyze the mass properties of the geometry. The two main types of solid-modeling systems are CSG (constructive solid geometry) and b-rep (boundary representation). CSG systems store only Boolean equations; the system creates geometry by evaluating the Boolean expressions. In b-rep systems, the system actually stores the geometry.

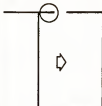


SPLINE Technically, a parametric polynomial curve whose points obey certain constraints. Used loosely to mean "curve." See "B-spline" and "Bezier curve."

SURFACE MODELING Required for NC models, surface-modeling systems demand more computational power than wireframes do, and are less natural for designers to use, but are more adaptable than solids. Surfaces are often defined by sweeping one curve along another. When shaded, surface models are indistinguishable from solids. But surfaces can be used to create objects within the computer that are topologically impossible to build, while solids cannot.

SYMBOL A grouping of geometry and text can be named and stored as a symbol in most CADD systems. It can then be recalled and placed in a drawing, at any scale and angle. Many systems store only a reference to a symbol within the drawing file, so that if the definition is changed, all drawings containing the symbol reflect the change. Some systems also allow symbols to be "exploded" into their component parts, which then become like any other geometry. Also known as "block" or "component"; in some systems, "macro."

TRIM To cut short a drawing element at its intersection with another element, such as a line or an arc.



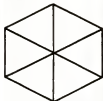
UNDO To reverse the effects of the preceding operation. Also called the "oops!" function.

UNGROUP Remove from temporary grouping. See "group."

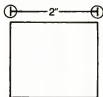
VECTOR As an adjective, contrasts with "raster." The vector approach to computer graphics entails the decomposition of images into edges; the program stores the coordinates of the endpoints of the edges rather than the entire line. All CADD systems store drawings and models in vector format. There are vector input, display, and output devices; a pen plotter is a vector output device.

WINDOW A "virtual terminal" giving the user an access port to the system or data. Windows can be used in some systems to hold different drawings or models; in others, only views of a single drawing or model can be simultaneously displayed. Windows are also used in some programs as a mechanism for grouping drawing elements.

WIREFRAME A computer representation of 3-D objects in which only edges are represented. Contrast with "surface modeling" and "solid modeling."



WITNESS LINES Lines extending out from a dimensioned object so that the dimension-labeling text can be placed where it will be legible.



WORKSTATION A display and one or more input devices, usually coupled with a single-user computer.

ZOOM Magnify the view, as when "zooming in" on a critical part of the drawing. —Joel N. Orr

■ LOW-COST CADD

THE FUTURE OF CADD CADD cannot get much cheaper. It must grow by adding features, adapting to new hardware, and—most importantly—by improving ease of use, which translates into performance and consistency.

Solid modeling has been attractive to leaders in architectural and mechanical design for some time. But these applications place such high demands on hardware that even large CADD systems have not yielded adequate performance. Designers are simply unable to tolerate delays of more than a second in the viewing of updated images, regardless of how complex those images are.

Workstation products in the \$100,000 range that provide this level of performance are just beginning to appear. Given the technological trickle-down rate, it will probably be 3 to 5 years before such functionality is available in \$5,000 desktop computers. But that wait could be cut short by hardware breakthroughs.

Some performance improvement happens independently of CADD development; hardware platforms get faster all the time without changes in software. But most CADD software is not equipped to take advantage of hardware improvements. For instance, many programs are not yet equipped to use large RAM spaces when they become available (through OS/2).

A clear trend is emerging in large CADD systems toward homogeneous representation of geometry—that is, the use of the same mathematical form to represent points, lines, curves of all sorts, surfaces, and solids. Right now, most systems—and certainly all low-cost systems—use different forms for each geometric entity. Consequently, each operation, such as Move, Erase, Trim, and so on, must be separately defined for each entity type. And combining operations, such as Fillet, must be separately defined for every combination of entity types. Code for this approach is therefore verbose and liable to have many subtle bugs.

By using a single representation form (the form of choice is the NURB, or non-uniform rational B-spline), CADD programs can be extremely compact and less likely to have bugs. But using NURBs for all geometry takes up more space and com-

putational resources than are available in current-generation PCs.

Another area for improvement is response time. IBM researchers have found that surprisingly small differences in system response time translate into large throughput improvements. Using the mainframe-based CADAM program from Lockheed Corp., experimenters found that decreasing the average response time from half a second to a quarter of a second resulted in doubling the number of transactions. Since many people cannot consciously distinguish the difference between such small time intervals, these results are counter-intuitive. But they mean that, for the most part, drafting productivity increases at the same rate that response time decreases. So users will demand—and will be willing to pay for—such changes.

On-screen kinematics is another area into which CADD is sure to expand in the near future. Many of the objects we build can move, or they let us move through them. We need to simulate that motion, and the more realistically, the better.

As for the human interface, we'll be stuck with the keyboard, the mouse, and the digitizing tablet for the next few years. None of these devices is intrinsically good or bad, but each package implements them differently. Voice input systems are another inexpensive input option (you can find voice input systems for as little as \$185), but CADD users have rejected them. Talking to your computer is still not socially acceptable in the engineering environment.

As a result, users must learn different commands and movements for different packages. This is tantamount to learning to drive different vehicles with accelerator and brake pedals in different locations: it can be done, but it's no fun. Unfortunately, there are no standards in sight for CADD human interfaces.

THE PRODUCTS OF TODAY Many of the newer, inexpensive CADD systems do offer easy interfaces, which is a start. If you wish to choose one of the systems available for less than \$500, you'll find the reviews that follow arranged alphabetically by product name. You'll also find a review of the latest version of AutoCAD for comparison.

AutoCAD

Boasting more than 100,000 registered users (as of May 1987), AutoCAD accounts for more than 50 percent of all CADD stations, including minis and mainframe stations.

While part of AutoCAD's popularity stems from its rich set of implemented features, the package stands out for its programmability. Its AutoLISP programming language (an implementation of LISP) and 1-2-3-like macros make it easy for users to modify or add to its menus and commands. These tools enable you to customize the package for any application and allow vendors to create third-party programs.

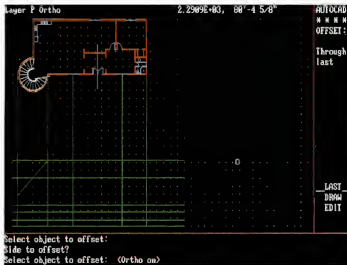
Indeed, hundreds of third-party vendors have taken advantage of AutoCAD's programmability to create add-on products. Autodesk publishes a book containing a description of all the known add-ins, complete with price, purchasing information, description, level of support, and so on. The most recent edition (fall 1986) lists more than 450 programs divided into 23 different categories that range from architectural construction and electronics engineering to mapping and CAM. AutoCAD also offers its own add-on, AutoCAD AEC, which supplies symbols and commands for architectural and engineering applications, and its \$500 AutoShade module, which was released in early September, turns the 3-D drawings you have created with AutoCAD into shaded renderings.

More than 150 training centers nationwide can teach you to use AutoCAD, and over 100 user groups support it. Among the many journals wholly devoted to AutoCAD are *Cadence*, *Cadalist*, *Final Draft*, and *A/E/C Newsletter*; also, CompuServe has a bulletin board for it.

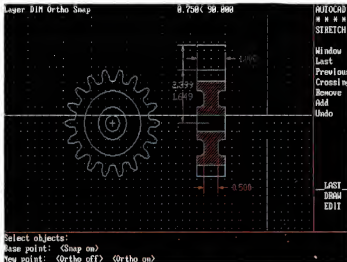
Because of this installed user base and add-on support, AutoCAD has become the de facto standard with which all other microcomputer CAD systems are compared. Though it costs \$2,850, we reviewed it here as a baseline against which to compare the low-cost alternatives in this issue.

Just as this article was going to press, Autodesk announced a new version of AutoCAD, called AutoCAD, Release 9. This new version boasts two substantial improvements over the version reviewed

■ LOW-COST CADD



AutoCAD gives you most of the features you need to create architectural drawings. And though it lacks a parallel-line feature, you can create one with AutoLISP. In the screen above, I used the offset commands to create the parallel construction lines that will enable me to begin an elevation drawing of a house.



AutoCAD's associative dimensioning feature is better than that of any other package reviewed in this issue. It allows you to see the dimensions change as you modify a drawing. For instance, on the cross section for the gear, the original dimensions are shown in purple, and the dimensions of the current cursor location are in white.

here. Release 9 allows you to transfer AutoCAD files among PC DOS, MS-DOS, DEC VMS, Sun UNIX, and Apollo Aegis file formats. This will allow people with different types of machines on the same network to share files directly. Release 9 also features a new user interface that includes pull-down menus, dialog boxes, and icon menus, which will make the package more accessible to the novice. Among other improvements, there are 20 additional fonts.

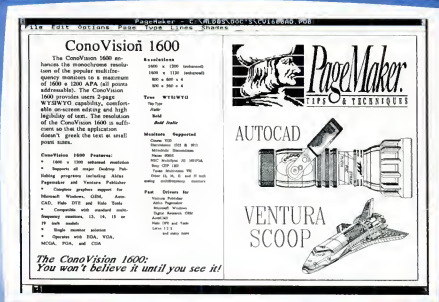
DRAW, SNAP, AND ZOOM In itself, AutoCAD offers a wide range of features, and whatever it doesn't offer can be easily programmed using AutoLISP. Predefined commands for geometric construction include automatic polygon closing and commands to produce absolute, relative, and polar coordinates. Although AutoCAD does not include a command for drawing parallel lines, you can easily create one with AutoLISP.

The package also offers the full range of grid and snap capabilities. For instance, you can give grids and snaps different x and y spacings, as well as relocate, rotate, or change them into an isometric mode. What's more, you can define almost any of the 80 system and dimension parameters.

You create a curve by first entering it as line segment, then converting the line segment to third-degree curve. However, if you need a cubic spline, conic spline, or Bezier curve, you'll need to write an AutoLISP program. Although AutoCAD offers a comprehensive set of predefined hatch patterns, it also lets you create single-hatched and crosshatched patterns on the fly, as well as to customize a hatch pattern. AutoCAD's selection-set features designate the area you want to hatch. Text, shapes, traces, and solids are not hatched through unless you specify otherwise; this provision allows you to hatch, say, a labeled pie chart without covering the labels.

AutoCAD lets you enter geometry in absolute, relative, or polar coordinates. Coordinate precision is floating point. You can also choose the unit of measure you want to use and change it at any time: for instance, translating a drawing from inches to millimeters is a simple five-step procedure. But if you want to combine units, say, when designing a mechanical engi-

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■ LOW-COST CADD

neering project in inches but using screws measured in metric units, you'll need to use AutoLISP.

Editing features are also comprehensive. You can trim and drag objects or group them for manipulation. The full range of Trim, Extend, Scale, and Stretch commands are available, and the Undo/Redo commands give you complete freedom to change your mind. Ideally, however, AutoCAD should not only allow you to trim a line to another line, but also to extend it. The program will let you reuse and modify the last group of objects selected, but once you create a new grouping, you lose the previous one. It would be better if AutoCAD allowed you to save all sets for later use.

AutoCAD's snap functions are among the most comprehensive of any package. You can snap to the center of an arc or circle; to the endpoint of a line, arc, or polyline; to the insertion point of a label or symbol; to the intersection of lines or arcs; to the midpoint of a line or arc nearest some point on a line, arc, or circle; to a node (point entity) perpendicular to a line, arc, or circle; to the quadrant point or tangent of an arc or circle; and to any combination of these or to a specified point on a grid (snappoint).

The zoom function also has many modes, though the ones most commonly used are the Window, Dynamic, Extents, Previous, and Scale modes. For ZOOM/Window, you must specify two corners of a rectangle box: the area of the rectangle then expands to fill the screen (zooming in). ZOOM/Dynamic allows you to zoom in or out on a windowed area; it shows you the limits of the entire drawing (zooming out) and whether a regeneration (drawing recalculation) will be required to zoom in or out on your selected window. This is quite useful for anyone with unusually large drawing files for which a regeneration would take several minutes.

ZOOM/Extents fills the screen with the drawn area (this is not to be confused with ZOOM/All, which shows the entire drawing area's limits). ZOOM/Previous brings back the last view (the way the screen looked before the last Pan or Zoom command); it also recalls the last five screen settings (including 3-D views).

ZOOM [n] takes the current screen

and magnifies it by the factor [n] without changing the screen's center point. For example, specifying ZOOM/E followed by ZOOM 0.8x shows everything in the drawing, then zooms out so that what is shown is 80 percent of its original size; hence you could use it to see a rectangle that borders the edge of the drawing.

The panning function works on the "from/to" principle. While AutoCAD allows you to zoom and pan to the next point as you draw a line, it would be nice if the program let you do that as you worked on other features.



FACT FILE

AUTOCAD



AutoCAD, Version 2.62

Autodesk, Inc.
2320 Marinship Way
Sausalito, CA 94965
(415) 332-2344

List Price: \$2,850, including ADI (AutoDesk Device Interface).

CAD AEC Architectural, \$1,000; AutoCAD AEC Mechanical, \$500; CAD/Camera, \$3,000; AutoShade, \$500.

Requires: 640K RAM, 20-Mbyte hard disk, 8087/80287 math coprocessor, DOS 2.0 or later.

Supports: BMW Graphics Adapter; Conographics Model 40; Control Systems Artist 1 and 2; Hercules monochrome graphics or compatibles; IBM CGA, EGA, VGA, or compatibles; Metheus Omega; #9 Revolution and NTIOS Graphic Display; Quadram Quadscreen; Sigma Design Color 400; Tecmar Graphics Master; Vectrix VX384 and Midas; VMI Image Manager, Microsoft Mouse and compatibles, Calcomp 2000, 2100, 2500, and 9000 series; Geographics Clump-on Drafting Board Digitizer; GTCO Digi-Pad Type 7; Hitachi HIBCOMSCAN and Tiger Tablet; Houston Instrument Series 7000 and HIPAD; KousaPad; Kurta Series One, Two, and Three; MUTOH EX3000; Neumatics 2200; Scripter SPD; Seiko DT-3103/4103; SAC Grafter GP-7 and GP-8; Summagraphics Bit Pad 1, MIM series, and Micro Grid Tablet. Any joystick; dot matrix and laser printers; plotters.

In Short: A flexible, powerful, full-featured CADD package that offers macros and a programming language. You can get hundreds of add-on programs that will allow you to tailor the package to any application. This is a package for heavy-duty production work, not for the casual user. Not copy protected.

CIRCLE 101 ON READER SERVICE CARD

DIMENSIONING AND SYMBOLS

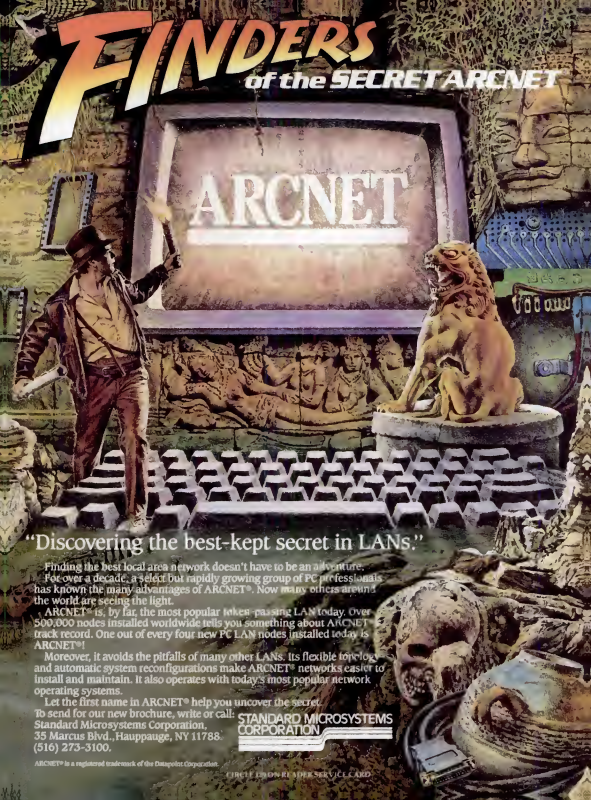
AutoCAD offers a plethora of dimensioning commands and controls, including baseline, angular, and continuing dimensions. Its associative dimensioning and control are the best that I've ever seen; these features alone would be worth the price of the package. Once you've placed dimensions on the drawing, you can use any scaling, stretching, trimming, or extending command to modify the appropriate dimension lines and text. As you modify the text, you can see the original dimensions as well as the modified dimensions of the drawing in progress. You can also define your own dimension-line terminators to suit the conventions of your particular office or application.

You can modify a dimension text, or label, but only if you explode it, separating it from the rest of the drawing. The modified dimension will not be associative. You have complete control over the position of the dimension text, witness lines, and tolerance notation. Tolerancing symbols, which allow you to specify a margin of error, are automatic. AutoCAD's dimension features lack only control over radius and diameter dimension-text locations, plus a Leader command that would read the dimension of whatever you indicate.

AutoCAD also provides several methods for calculating areas and perimeters. Center of gravity and other mass properties, however, are available only as AutoLISP functions.

You can make and place symbols easily. When you place a symbol, you can modify its x, y, and z scales and its rotation. AutoCAD does not allow you to rotate the symbols (or anything else) in three dimensions without using AutoLISP. Moreover, when you turn something into a symbol, it disappears from your screen. While this quirk doesn't matter if you're just creating symbols, it can be annoying when you want to turn part of an existing drawing into a symbol; you lose not only the symbol but all indication of its position.

AutoCAD stores all drawings with the extension .DWG. You can store symbols either as part of a particular .DWG file or as a separate file with the .DWG extension. As a result, any drawing can become a symbol and can be placed into another



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■ LOW-COST CADD

drawing. When you place a global symbol into a drawing for the first time, you are really inserting a copy of it into the drawing so that you can use the same symbol repeatedly.

You can change symbols globally by using the `INSERT [name]=` command. This feature gives you a great deal of control, but may confuse the inexperienced user. Once a user gains fluency, though, this technique and others help in the management of the symbol and drawing libraries, an important part of the productivity and profitability of any CADD system.

REPORT GENERATION *AutoCAD* provides extensive attribute creation, manipulation, and report-handling capabilities. It imposes no limits on the size of non-graphical attributes. Reports can be generated in delimited, fixed-length, and DXF formats, and *AutoCAD* allows you to import and export files to and from other systems via IGES, DXF, or DXB formats. Line type, thickness, width, color, and layer are the main graphic attributes available you can specify. A third dimension—the *z* dimension—is available for certain entities.

AutoCAD comes with six text fonts: one vertical, one monospaced, and four proportional-spaced fonts; you can also create or purchase additional fonts. The system gives you a great deal of control over each font, including the freedom to select text height, aspect ratio, character slant, insertion angle, justification, forward- or backward-reading type, upside-down or right-side-up orientation, layer, and color.

We did find some problems with the text modification procedure. Because the pertinent command controls both the text and its location, you must specify both at the same time. Even if you simply want to modify text, you must locate the exact point where it begins—not a trivial matter when you're working in dense drawings. In addition, you must reenter the text. Most power users use resident editors like *SideKick* to get around this deficiency, but it should be addressed by Autodesk. These issues are partially addressed by some of the *AutoLISP* programs on the bonus disk that users receive when they send in their registration cards.

EASE OF USE In *AutoCAD*, as with many other programs, flexibility comes at the expense of ease of use. To get the most out of the program, it pays to invest the time and money it takes to learn the various third-party add-ons and customization capabilities. The package's prompts and method of selection are oriented toward the advanced user (for instance, the user is allowed to back out of what was just done, without being required to confirm the command). The occasional user may have

■ *AutoCAD* provides extensive attribute creation, manipulation, and report-handling capabilities.

some trouble remembering the best way to go about a particular function and probably will need to rely heavily on the menu system.

Fortunately, you can create custom menus that simplify the program's operation for occasional users. For example, you can create specialized menus, tablets, scripts, and symbols for a company that designs kitchen cabinets. The menus would prompt the user for the necessary information, including the location on the wall where a cabinet will go; plus the cabinet's brand, model, and its dimensions. Then the macro would place the right cabinet in the appropriate location.

The on-line help is limited to a description of each function and its modes, with a page reference to the manual. The cursor does not change its shape or form except for 3-D viewing and in isometric mode. Also, the cursor does show the limits of selection areas for various modes and carries symbols when they are being placed.

VIEWS Only one view or window of the database is available at any given time. You can name and save views for later recall, and you can also use them as plotting parameters.

TEST RESULTS *AutoCAD* includes all of the functions that were necessary to draw the test gear easily. Using the mirror and circular-array functions made it necessary to construct only half of the gear tooth.

Creating the architectural drawing was hampered only by the package's lack of a parallel-line function for drawing double-line walls.

AutoCAD came in at the middle of the pack on the PC Labs performance tests, with a redraw time of 17.95 seconds and a delete time of 4.65 seconds.

ROBUSTNESS *AutoCAD*'s drawing files are virtual RAM-resident, which means that *AutoCAD* stores as much of the drawing in RAM as it can and shuttles the rest to disk. If you lose power, you'll also lose any modifications made since the last save. If the disk is full, or if *AutoCAD* cannot function for some reason, *AutoCAD* will prompt you to save all changes.

AutoCAD's documentation is excellent: all of it is professionally presented, ample in scope, and quite useful. The reference manual is well written and properly indexed, typeset, and bound in 8½- by 11-inch boxed format. *AutoCAD* also comes with sample issues of *Cadalist* and *Final Draft*, plus a free subscription to *Cadence*—three valuable journals full of tips, hints, programs, and information on the *AutoCAD* aftermarket. More than 25 books are now available on *AutoCAD* use, training, productivity, and management.

Installing *AutoCAD* was neither simple nor automated. You'll need to know DOS and your equipment. The documentation suggests that you specify certain parameters in your `CONFIG.SYS` file, though most parameters have default values that are acceptable for initial work. The program installation procedure is well documented, and those familiar with DOS will find it fairly straightforward.

In sum, *AutoCAD* leads the market because it is full-featured, flexible, and programmable, and because of the tremendous third-party support and add-ons available for it. It is not meant for the casual user. To get full value for your money, you'll need to take the time and effort required to mine its flexibility.

—W. Bradley Holtz



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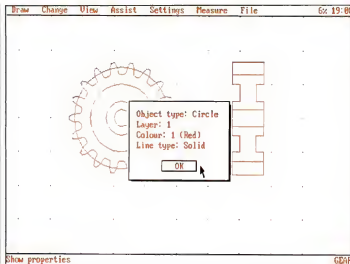
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AutoSketch

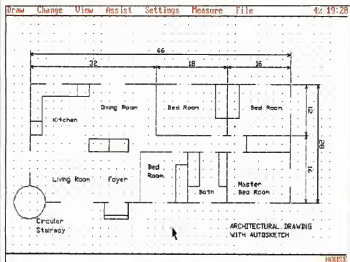
For \$99.95, Autodesk's *AutoSketch* is an inexpensive system that's easy to learn and use. This object-oriented, vector-based CAD program offers precision to seven significant digits and makes an excellent tool for teaching CADD or for creating simple architectural-type plans. However, its lack of certain functions, such as radial dimensioning and the ability to array an object, makes it unsuitable for professional architects and mechanical engineers.

Autodesk offers two versions of this package: the \$99.95 Enhanced version, reviewed here, and the \$79.95 Standard Version. According to Autodesk, the Enhanced version, with its math coprocessor, is more than nine times faster than the Standard version, which comes without the math chip. Although most users will probably want the speed of the Enhanced package, educational institutions on tight budgets might opt for the less expensive version.

Although this package comes from Au-



AutoSketch's user interface, with its menus and dialog boxes, is considerably better than AutoCAD's. But it doesn't have enough capability for easy construction of the gear tooth: it lacks a fillet function, many arc construction methods, and a circular array feature. We used the less efficient Rotate and Mirror commands to produce the 18-tooth gear.



AutoSketch lets the casual user create detailed floor plans, elevations, and details. You can choose from seven colors and ten line types for your drawings. Associative dimensioning is also available. Though AutoSketch lacks a double-line feature, you can draw single-line walls by specifying relative, absolute, or polar coordinates.



FACT FILE



AutoSketch,
Version 1.01
Autodesk Inc.
2320 Marinship Way
Sausalito, CA 94965
(415) 332-2344
List Price: Enhanced
version (with math co-

processor and Autodesk Device Interface), \$99.95; Standard version (with Autodesk Device Interface), \$79.95.

Requires: 512K RAM, two disk drives, DOS 2.0 or later, 8087/80287 math coprocessor for Enhanced version.

Supports: Hercules monochrome graphics adapter, IBM CGA (in monochrome mode), IBM EGA; Microsoft Mouse; Koalpad; any joystick; dot matrix and laser printers; plotters.

In Short: An inexpensive, easy-to-use package with many highly sophisticated features such as associative dimensioning. However, its lack of an array function and of radial dimensioning limits its use for architectural and mechanical engineering applications. This is good for educational uses or casual drafting applications. Not copy protected.

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■ LOW-COST CADD

desktop, the same company that makes *AutoCAD* (a powerful and complex program for production drafting), the two packages bear little resemblance to each other.

DRAWINGSCREEN *AutoSketch*'s user interface is considerably better than *AutoCAD*'s. *AutoCAD*'s menu system displays only one screen menu at a time even though it has many levels of menus and submenus. *AutoSketch*'s menus, however, are all pull-down menus and consist of seven menu names arranged in a horizontal bar across the top of the screen. *AutoSketch* also uses 20 PC function-key combinations for the most common commands and functions.

Once you've made a selection, a vertical menu of commands and functions appears. When you choose commands such as Line, Circle, and Text, the program prompts you for your next action. For instance, when you select the Line command, the prompt line says "Enter point."

Interestingly, drawing and text commands remain entered until you issue a new drawing or text command. This allows you, for example, to adjust the snap resolution of your grid or select a new layer, then continue drawing without reentering the Line command.

When you use the Grid and Layer commands, a dialog box pops up in the middle of the screen and prompts you to enter or confirm information. The self-explanatory nature of the dialog boxes makes them very easy to use.

AutoSketch's screen includes a memory usage meter. This meter is important because *AutoSketch* keeps the entire drawing in RAM. An empty screen uses 1 percent of memory, and memory usage increases with the complexity of the drawing. When it approaches 100 percent, you should save your drawing to disk. In the case of my gear drawing, memory usage grew to only 6 percent. As a rule of thumb, you can create a C-size (17- by 22-inch) drawing of moderate complexity before you reach this upper limit.

STARTING A DRAWING *AutoSketch* includes a facility for setting the drawing limits to define imaginary boundaries for drawings. Neither *AutoSketch* nor *AutoCAD* will allow you to plot anything drawn

outside those limits. For example the lower-left-hand corner can remain at the default setting of 0,0 while the upper-left-hand corner can reflect the total number of scaled drawing units in both the x and y directions. For example, you can set the upper-right-hand limit for a full-scale (1 inch = 1 inch) drawing based on an 8½- by 11-inch sheet at 10, 7 inches.

AutoSketch also offers a grid that represents the drawing area defined by the limits. Using *AutoSketch*'s Zoom Limits command, you can fill the entire display with the drawing.

■ *AutoSketch*'s sophisticated features such as fast zooms and pans, dynamic drag, and associative dimensioning rival those of systems costing thousands.

AutoSketch's use of layers is straightforward. You can use up to ten layers per drawing, any combination of which can be visible or invisible. On any layer, entities can appear in one of seven colors and in one of ten line types. Though each requires separate steps, changing entity layer, color, and line type is simple.

Associative dimensioning, a feature usually found only in much-higher-priced systems, is available. Associative dimensions change as objects are stretched or scaled.

With *AutoSketch*'s Undo feature, you can undo your last operation and can even back up to the very first operation of the drawing session. Likewise, you can redo an Undo if you've gone a step too far.

The object selection feature is ingenious. The program uses a hand symbol, rather than the cursor, for selecting entities. If you click in an empty area on the screen, a window appears as you move the pointing device. If you specify a second

corner to the right of the first, *AutoSketch* draws a window bordered by a solid line. You can select only objects that lie entirely within this window. If the second corner is to the left of the first, a dotted window appears. All objects that cross or lie within this window are selected.

GEAR CONSTRUCTION *AutoSketch* does not have enough capability to make construction of an accurate gear tooth drawing easy. The lack of a fillet function and of variable arc construction methods made it impossible to create the .062 radius on the gear tooth accurately.

Since *AutoSketch* also lacks an array function, I used a combination of its Copy, Rotate, and Mirror commands to produce 18 accurately spaced teeth. However, the process took at least ten times longer than it would have if a circular array function had been available. This is not a program that a serious-minded mechanical engineer would use for day-to-day drafting and design work.

Using *AutoSketch*'s Ortho and Object Snap (called Attach) features, I quickly and accurately created the side view of the gear by projecting horizontal lines. The Break and Attach features allowed me to erase the unwanted construction (projection) lines quickly. Since *AutoSketch* does not contain fillet and hatch functions, I could not fully complete the side view.

After constructing the side view, I realized I had incorrectly made the view 1½ inches wide instead of 1 inch wide. Using the Stretch command, I quickly fixed the mistake.

ARCHITECTURAL DRAWING *AutoSketch* lets the casual user create detailed floor plans, elevations, and details.

To draw the floor plan, I first had to identify the paper size and scale, then define the drawing limits. I chose to use a small-format (8½- by 11-inch) sheet and a scale of ¼ inch = 1 foot. Having previewed *AutoSketch*'s printing parameters, I knew I would be able to print on most of the sheet (7.98611 by 11 inches, to be exact), so I chose to round these numbers down to 10 inches, which gave me a border around the sheet. Hence my limits multiplied out to 56 by 80 feet.

I set the Grid feature to 2 so that the dis-



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tance between each grid dot represented 2 feet. The 2-foot grid created a modular system on which to lay out the architectural floor plan. Similarly, I set the Snap facility to 1 to cause the screen cursor to move in increments of 1 foot.

Though *AutoSketch* lacks a double-line feature, I could easily draw single-line walls by specifying their polar coordinates—that is, line lengths and angles. The program lets you enter absolute and relative coordinates.

Although *AutoSketch* was one of the more fully featured packages tested, it was also one of the slower ones. On our performance tests, the package's screen redraw took 32.07 seconds—three and a half times as long as the fastest package. The delete took 20.18 seconds, or about one fifth as fast as the fastest package.

OBTAINING OUTPUT To prepare for printing, *AutoSketch* allows you to specify paper size, plot size, and drawing scale in units of inches or millimeters. You can also rotate the drawing by 90 degrees.

Although *AutoSketch* can create a DXF file, it will not read one. The program can neither read nor write an IGES file.

INSTALLATION Installing the package on a hard disk is simple. Just create a new directory on your hard disk and copy the three files from the *AutoSketch* program disk. An easy-to-use hardware configuration menu that appears automatically the first time you run *AutoSketch* groups all plotter and printer devices in one menu. Consequently you can select only one at a time, which can be a disadvantage if you have both a printer and a plotter, though it is easy to switch from one to the other.

I was pleased to see *AutoSketch*'s support for path specifications, a feature often missing in low-cost packages. In addition, you can easily review the files in one or more subdirectories, and it is simple to pick and load a file without having to type its name—a nice feature that should be integrated into *AutoCAD*.

The *AutoSketch* user guide is amazingly small. Though brief, the documentation contains enough information for the experienced PC user to get started. And once started, most experienced PC users will have little trouble learning the program on

their own. However, even though it includes a tutorial, the user guide may be less than adequate for the first-time PC user. As a supplement to the user guide, *AutoSketch* comes with a quick-reference guide that illustrates its seven pull-down screen menus. Technical support was polite and helpful.

CONCLUSION *AutoSketch* is an outstanding introductory CADD program and, at only \$99.95, a great value. It contains sophisticated features such as fast zooms and pans, dynamic drag, spline curves, Undo/Redo, and Stretch commands, and associative dimensioning—features that rival those of systems costing thousands. However, the program could be improved by the addition of leader line and array functions. As is, *AutoSketch* is an excellent choice for the less serious drafter but would not fulfill the stiff requirements of most mechanical engineers and architects. Without question, its greatest impact will be in educational institutions, industry training programs, and in less stringent drafting applications.

—Terry Wohlers

Cadkey 1

Cadkey 1, Version 1.4E, by CADKEY (a division of Micro Control Systems), is an easy-to-use 2-D and 3-D CADD system that is a stripped-down version of the company's high-end CAD system for the PC, *Cadkey*, Versions 2.1 and 3.0. *Cadkey 1*, Version 1.4E, is the commercial successor to *Cadkey*, Version 1.4E, which was designed as a training tool and made available to schools as a grant on a site-license basis; this version was formerly available to students for \$99. *Cadkey 1*, Version 1.4E, is sold for \$395.

Like its predecessor, *Cadkey 1*, Version 1.4E, is designed to work without a hard disk, which is helpful for schools and students strapped for funds. The package offers about 85 percent of the functionality of its big sibling, which costs \$2,695 for Version 2.1 and \$3,195 for Version 3.0. *Cadkey 2.1*—besides including all the *Cadkey 1* features, contains macros, a programming language, links to computer-aided manufacturing packages that drive lathes and milling machines, advanced en-



FACT FILE



Cadkey 1, Version 1.4E
CADKEY
Division of Micro Control Systems Inc.
27 Hartford Tpk
Vernon, CT 06066
(203) 647-0220
List Price: \$395; IGES

translator, \$750

Requires: 512K RAM, two disk drives or hard disk, DOS 2.0 or later. 8087/80287 math coprocessor recommended.

Supports: AT&T Display Enhancement board and indigenous graphics board; Convosion 40; Hercules monochrome graphics or compatibles; IBM CGA, EGA, VGA, VGA+, or compatibles; Imagraphy AGC4; Metheus Omega; Number 9 Revolution series; Sigma Color Design 400; Tecmar Graphics Master; Vericom M16 (with 640K RAM); Microsoft Mouse and compatibles; Calcomp 2000 and 2500; Cherry Digitizer; GTCO Digi-Pad Type 5A; Hitachi Pad; Pad: Houston Instrument HiPAD and True Grid; Kurta Series One and Two; Namonics 2200 series; Polytek Keypoint Board Tablet 60 and 300; Script SPD series; Summagraphics Bit Pad 1.2 and 1103, MM digitizer series and Microgrid; Dot matrix and laser printers; plotters.

In Short: A full-featured, true 3-D CADD package. Not copy protected.

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gineering functions, and the ability to export DXF files. *Cadkey 3.0*—besides including the other features mentioned—contains an enhanced programming language and templates for use with digitizing tablets. *Cadkey 1* is not appropriate for a production drafting environment but is excellent for educational or casual use.

USING THE PACKAGE *Cadkey 1*'s display is both well designed and good-looking. The screen is divided into three sections: one for the menu options, status and cursor-tracking window on the left side of the screen, another for a history line at the top, and a third for the prompt line at the bottom. *Cadkey 1* is strictly menu driven. As you select menu options, they appear at the top of the screen in the history line to remind you of your position in the command menu; meanwhile, the prompt



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Actual unretouched screen image

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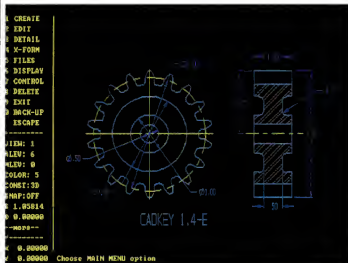
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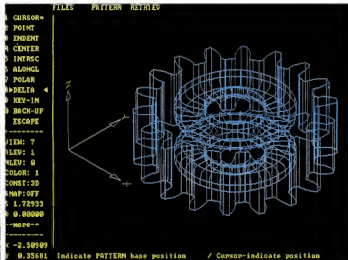
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■ LOW-COST CADD



The 2-D gear drawing was relatively easy to create because of the package's impressive radial array and chamfer features; only its lack of a mirroring function made the gear drawing slightly more difficult and time-consuming than it should have been. The package also offers a useful automatic dimensioning feature for radii.



Cadkey excels in its ability to define three-dimensional drawings like the isometric view of the test gear drawing shown above. Cadkey 1 also allows orthographic and axonometric views. Its sole drawback is that it furnishes only a wireframe representation; hence complex objects look cluttered.

line displays all system prompts and user input. Because of these prompts, the user does not have to memorize a lot of commands and command modifiers. On the other hand, this method does make the program slower than command-driven systems.

Cadkey 1 also gives you the option of using escape codes instead of menu selections. For example, Esc-F1-F1 calls up the line function. The package features an immediate mode that lets you invoke the most frequently accessed functions by using either Alt or Ctrl combined with an assigned letter. You can use the immediate mode to jump from one function to another without exiting your current function. For instance, when you're in the line function, you can access another function such as another layer, or a snap or grid, without exiting the line function. You can, therefore, resume drawing after executing one of these commands without entering extra commands. You may pick immediate modes from the status window at any time. And after your selection, the program returns you to your previous location in the menu structure.

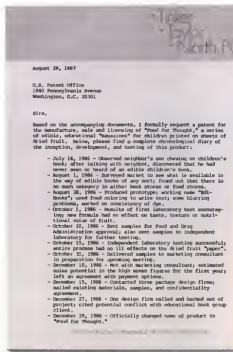
Editing commands include Scale, 2-D Rotate, Delete, Trim, and Extend, although *Cadkey 1* does not let you stretch a line or an arc to a new point. Entities include points, lines, arcs, circles, dimensions, and text notes. Coordinates use both floating point and double precision.

You may select entities for deletion by mask, single selection, level, group, window, type, or all displayed. If you delete an entity by mistake, you can restore it, but you cannot undo your last command.

You can create or file either symbols or patterns using the create function. You may choose from two file types for symbols: an entire drawing, which is called a part, and a pattern or group of entities that you can call into a part file. You can insert a symbol into your current drawing, as well as replacing the current part (or drawing). You can scale and rotate patterns when you insert them, but you can't drag an object. One handy feature lets you save an entire view as a pattern and insert it into a drawing.

Cadkey 1 also allows you to group entities. You can select entities individually by specifying the name of the group, or by us-

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Jan 2, 1988

Initial idea, first attempts at printing story.

Jan 22 -

Refined formula for dried fruit.

Shopped for food processing plant.

Feb 15 -

Researched market - no direct competition.

Feb 21 -

Registered letter to sell.

concepts: sketches, specs, bids, names, formulas.

Mar 27 -

Sent samples to Food & Drug Admin. for tests.

Sep 10, 1988

Safety tests initiated;

ingredient research started.

Sep 26 -

Registered name and trademark.

for product "SMART SNACKS."

Oct 11 -

Financial backing obtained.

Oct 26 -

Safety test results back;

package design approved.

Nov 17 -

Market research results back;

ingredient coverage obtained.

Dec 9 -

Contracted patent attorney;

met with three ad agencies.

Dec 11 -

Distributed samples & documentation to attorney.

Dec 27 -

Presentation to Board of

Directors and Officers of Patents.

U.S. Patent Office
1840 Pennsylvania Avenue
Washington, D.C. 20501

September 7, 1987

Dear Sirs,

With the attached notes and drawings

as background, I am officially sub-

mitting a patent for the manufacture,

sale and licensing of the product

"SMART SNACKS," the edible

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"SMART SNACKS" are

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ing the cursor to choose the group. You may have up to 256 subgroups contained within each group. The package lets you add entities to a group, delete a group, list groups contained within the same drawing (or Part) file, make a group by selecting entities, and degroup a group.

The package lets you add entities to a group, delete a group, list groups contained within the same drawing (or part) file, make a group by selecting entities, and degroup a group.

As you retrieve groups and insert them into a drawing, you assign them a subgroup number that may be used to process a bill of materials. However, you can extract a list of groups only within the drawing with this bill of materials feature. For a truly useful bill of materials, you would need to be able to output the list to a spreadsheet or database for sorting and manipulation and to a text file or a printer for a report. It would help if the documentation included a good illustration of how to use this feature.

Cadkey 1 allows up to 256 layers. While you can define multiple line types and colors on any layer, you cannot set all entities on a layer to a single color without using the ATTRIB function.

The program does not let you create rectangular arrays, but you can use the 2-D rotate function to generate circular arrays.

3-D CAPABILITIES *Cadkey 1* excels in three-dimensional drawing—particularly in its ability to define multiple views. The program provides six standard orthographic views, plus isometric and axonometric views. The user can define an unlimited number of other views in which to work. Once you have defined a view, you recall it by selecting the view function from the status window without exiting the current command; this makes it easy to define entities (for instance, the beginning and ending of a line) in different views. Missing is the option of displaying and working on multiple views simultaneously.

Another sophisticated feature is *Cadkey 1*'s ability to take a two-dimensional cross section of an object and revolve it by using the join and sweep functions to produce a three-dimensional object.

Unfortunately, since *Cadkey* was wireframe representation, complex objects

tend to become cluttered and difficult to understand. A hidden-line-removal function would be nice to have.

Also missing is the ability to read and write DXF files. While you can purchase an optional IGES translator, you'll have to spend \$750. So if you need that function, you might want to consider purchasing *Cadkey 2.1*, which supports DXF. You can easily move drawings between any version of *Cadkey*.

INSTALLATION Installing the software is very simple with the program's auto-install routine. If you prefer written instructions, a concise section in the reference manual walks you through the installation and setup process. *Cadkey 1*'s CONFIG program is menu driven, allowing you to have the package up and running in less than 10 minutes.

The *Cadkey 1* documentation, which includes a tutorial, is generally easy to follow, though additional illustrations and examples would be helpful. Descriptions of editing and entity manipulation functions are available, but they are scattered throughout the documentation. An effort to consolidate the references to these commands into a single section entitled "Editing" would be greatly appreciated. You might want to consider supplementing your documentation with the book, *Using Cadkey*, by Resettaris and Bertoline (ISBN 08-273-29660; Delmar Publishers, Albany, N.Y., 1987). *Cadkey 1* also has Micro Control's dealer network and telephone support behind it.

The tutorial is very consistent and contains enough examples to get you started. This package is simple to learn, and once you master the functions you can easily create a drawing.

TEST DRAWINGS The test drawings were easy to do. We used the 3-D function to devise a fairly complex set of geometry and make a multiview drawing in a short time. This capability represents a vast improvement over many so-called 3-D packages. In general, the *Cadkey* programs represent a vast improvement over *AutoCAD* in defining complex objects that include curved surfaces. All versions of *Cadkey* handle curved surfaces, though Version 3.0's support is the most sophisticated.

Two drawbacks proved annoying while I was working on the drawing, though. First, the lack of a Mirror command caused me to spend more time than necessary on the gear drawing. (In all fairness, the package does offer a circular array feature that made constructing the gear easy once you complete the first tooth.) Second, there is no way to retrieve the last point input. Consequently, when you work with relative coordinates, you have to reenter the last endpoint—and input an extra command. It would help if the program could include the last point as a way to indicate position.

In general, I was very pleased with this package. With its excellent 3-D capabilities, *Cadkey 1* is a lean and mean version of Micro Control's high-end product line. Anyone who is considering purchasing a low-cost CADD program for general drafting purposes should take a close look at *Cadkey 1*. While this is not production-level software because it's not customizable, it will serve the educational market and casual users well.

Cadkey 1 contains both 3-D and display plane definition capabilities that are found in more-expensive micro-based CADD packages. You can work in view and world coordinates (that is, three-dimensional coordinates) to define geometry, including arcs and circles. The ability to work in views other than standard orthographic projection makes definition of complex objects easy. A package for under \$400 with these features deserves attention.

—Steven Foster

CCS Designer

Complete Computer Services' *CCS Designer*, at \$79.95, offers just the basic drawing features and has an awkward user interface.

The package includes line, point, circle, arc, ellipse, multipoint curve, spline, and rectangle drawing elements. Its editing features consist of selection, erase, unanimated moves, mirroring, and rotation. It does not offer more-sophisticated CADD features such as extend, fillet, chamfer, drag, or hatching.

The user interface is relatively unsophisticated as well. To use *CCS Designer*, you specify points in the drawing by abso-

■ LOW-COST CADD



Low-Cost CADD: Summary of Features

(Products listed in ascending price order)


OPTIONAL MODULES

Curve Digitizer \$5.00 (manual, \$49; Registration Package, \$89)	AutoSketch \$79.95 (Standard); \$99.95 (Enhanced)	CCS Designer \$79.95	TurboCAD \$99.00	Generic CADD \$99.95	LaserCAD \$99.95	EasyCAD \$169.95
(1) Architectural Symbol Library, \$15; (2) Electronics Sym- bol Library, \$10	None	(1) CCS DXF, \$39.95; Symbol Library: (2) Vol. 1, \$29.95 (3) Vol. 2, \$29.95 (4) Vol. 3, \$29.95	Symbol libraries: (1) Architectural, (2) Electrical, (3) Flow Charting, (4) Home Furnishings, (5) Mechanical, \$29 each	(1) Auto Convert, (2) Auto Dimensioning, (3) DotPlot, (4) Drafting Enhancements-1, (5) Drafting En- hancements-2, \$49.95 each; (6) Generic IGES, \$249.95	None	None

ENTITY DRAWING COMMANDS

		Curve Digitizer	AutoSketch	CCS Designer	TurboCAD	Generic CADD	LaserCAD	EasyCAD	ENH-CAD	MATC CADD	Drafts 1 Plus	Drafts 3D Modeler	ProDesign II	Cadkey I	Pro 3D PC	ECAD Drafting Software	ie's Vision	AutoCAD
Graphical entry		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Keyboard entry	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Rectangular coordinates	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Absolute	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Line	Relative	○	●	○	●	●	●	●	●	●	●	●	●	●	○	●	○	●
	Polar coordinates	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Absolute	●	●	○	●	●	●	●	●	●	○	○	●	●	○	●	○	○
	Relative	●	●	○	●	●	●	●	●	●	○	○	●	●	○	●	○	○
Point	Automatic polygon closing	○	●	○	○	○	●	○	○	○	●	○	○	○	○	○	○	○
	Automatic continuation of Line command	●	●	○	○	○	●	○	○	○	●	○	○	○	○	○	○	○
	Variable width	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○
	Parallel lines	○	○	○	○	(4)*	○	○	○	○	○	○	○	○	○	○	○	(1,2,3)
Circle	Specified angle	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○
	Specified length	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○
	Center/radius	●	●	●	○†	●	●	●	●	●	○	○	○	○	○	○	○	○
	Center/diameter	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Arc	3-point	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	2-point	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Other	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	3-point	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○
Ellipse	Other	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Elliptical curve	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Spline curve	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Bezier curve	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Pie section	Pie section	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Rectangle	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○
	Rounded rectangle	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Polygon	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Polyline	Regular	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Irregular	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Arrows	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Arrows	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

PC—Indicates Editor's Choice ●—Yes ○—No *Numbers in parentheses refer to module numbers. †Circles can be drawn only as arcs. ‡Implemented as separate Draw commands. §For certain operations only. Most edit functions require selection view window. †AutoLisp gives you the ability to access the Selection Set.

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[illegible][illegible]

^d Program operates under Windows. Other drawings can be opened, but multiple views of the same drawing cannot be displayed. ^e In 'tool mode' only. ^f A provided facility lets you enter information for use in a future release. ^g Output through *Drafix 1 Plus*. ^h 10.7 million with *AutoShade*.

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EDITING COMMANDS																		
Selection	Objects	●	●	●	● ¹	○	●	●	○	○	●	●	○	●	●	○	●	○ ²
	Groups of objects	○	●	●	● ¹	○	●	●	○	○	●	●	○	●	●	○	●	○ ²
	Windows	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○ ²
	No. of multiple windows	1	Unlim- ited	1	1	None	1	1	1	None	Unlim- ited	4	1	1	4	1	1*	Unlim- ited
	Last object	●	○	○	○	●	○	○	●	○	○	○	○	○	○	○	○	○
	By entity type	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Erase		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Unerase		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Move	Animated	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Unanimated	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Copy		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Arrays	Rectangular	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Circular	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Mirror		●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Rotate		●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Endpoint join		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Resize		●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Multiple layers		●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Fill		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Break/trim	Lines	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Circles/arcs	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Other entities	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Extend		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Fillet		○	○	○	○	(4)*	○	○	○	○	○	○	○	○	○	○	○	○
Chamfer		○	○	○	○	(4)*	○	○	○	○	○	○	○	○	○	○	○	○
Segment line/arcs		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Undo		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DISPLAY CONTROLS																		
Zoom	By magnification factor	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
	By window	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Named views	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Restore original view	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Pan		●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Drag		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Displays cursor coordinates		●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Displays object dimensions		●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Adjustable drawing size		●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Adjustable units		●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Projection aids		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Cursor icons		●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Page display		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Indicates Editor's Choice ●—Yes ○—No *Numbers in parentheses refer to module numbers. †Circles can be drawn only as arcs. ‡Implemented as separate Draw commands. † For certain operations only. Most edit functions require selection view window. † AutoLisp gives you the ability to access the Selection Set.

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DIMENSIONING																		
Linear	Horizontal	●	●	●	●	(2)*	●	●	●	●	●	○	●	●	○	●	○	●
	Vertical	●	●	●	●	(2)*	●	●	●	●	●	○	●	●	○	●	○	●
	At an angle	●	●	●	●	(2)*	●	●	●	●	●	○	●	●	○	●	○	●
Rotated text		○	●	○	○	(2)*	●	●	○	●	●	○	●	○	○	●	○	●
Degrees of angle		●	○	○	○	(2)*	●	○	○	●	○	○	●	○	○	●	○	●
Baseline (stacked)		●	○	○	○	(2)*	●	○	○	●	○	○	○	○	○	●	○	●
Chained		○	○	○	○	(2)*	●	○	○	●	○	○	○	○	○	●	○	●
Diameter		○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	●
Radii		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Extension lines		●	●	○	●	(2)*	●	●	●	●	○	○	●	○	○	●	○	●
Line terminators	No. of types of arrowheads	1	1	1	1	5 (2)*	2	1	1	1	23	None	1	1	None	4	None	User-definable
	Tick marks	○	○	○	○	○	●	○	○	○	●	○	○	○	○	●	○	●
	User definable	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	●
Tolerances		○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	●
Leaders		○	○	○	○	(2)*	○	○	○	○	○	○	○	○	○	○	○	○
Center marks		●	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○
MEASURE																		
Distance	Point to point	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
	Shortest perpendicular	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Area		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Perimeter		●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
SYMBOLS (blocks)																		
Named		●	○	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Select from directory while drawing		●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Scale on insertion		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Rotate on insertion		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Mirror on insertion		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Attributes		○	○	○	○	○	○	○	○	○	○ ^{††}	○	○	○	○	○	○	○
HATCHING																		
Rectangles		●	○	○	○	(5)*	○	○	○	○	○	○	○	○	○	○	○	○
Circles		●	○	○	○	(5)*	○	○	○	○	○	○	○	○	○	○	○	○
Polygons	Regular	●	○	○	○	(5)*	○	○	○	○	○	○	○	○	○	○	○	○
	Irregular	●	○	○	○	(5)*	○	○	○	○	○	○	○	○	○	○	○	○
Curved boundaries		○	○	○	○	(5)*	○	○	○	○	○	○	○	○	○	○	○	○
Around holes		●	○	○	○	(5)*	○	○	○	○	○	○	○	○	○	○	○	○
User-defined patterns		○	○	○	○	(5)*	○	○	○	○	○	○	○	○	○	○	○	○

* Program operates under Windows. Other drawings can be opened, but multiple views of the same drawing cannot be displayed. ^{††} In Tool mode only. ^{††} A provided facility lets you enter information for use in a future release. ^{††} Output through Drafts 1 Plus. ^{††} 16.7 million with AutoSketch.

(continues)

■ LOW-COST CADD



Low-Cost CADD: Summary of Features

(Products listed in ascending price order)

NONGRAPHABLE ATTRIBUTES		Current Digitizer	AutoSketch	CCS Designer	TurboCAD	Generic CADD	AutoCAD	EasyCAD	EnhCAD	MATC CAD	Drafts 1 Plus	Drafts 3D Master	ProDesign II	Cadkey I	Pro 3D PC	ECAD Drafting Software	In "x" Vision	AutoCAD
Visible/invisible		●	○	○	○	○	●	○	○	○	○	○	●	○	○	●	○	●
Editable		●	○	●	○	○	○	○	○	○	○	○	●	○	○	○	○	●
Output as text file		●	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●
HELP																		
On-screen		●	○	●	○	○	○	●	○	○	○	○	○	○	○	○	○	○
Context-sensitive		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Disk tutorial		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
PLOTTING CONTROLS																		
Variable sizing		●	●	●	○	○	○	○	○	○	○ ^H	(and with 1, 2) ^H	○	○	○	○	○	○
Variable orientation		○	●	●	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
Plots part of drawing	By window	○	●	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
	By layer	○	○	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
	By attribute	○	○	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
Pen control	Speed	○	○	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
	Force	○	○	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
	Acceleration	○	○	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
Automatic scaling		○	○	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
Precision scaling		○	○	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
Speeding		○	○	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
Plot file optimization		○	○	○	○	○	○	○	○	○	○	○ ^H	○	○	○	○	○	○
Dot-matrix plot		○	○	○	○	(3) [*]	○	○	○	○	(1) [*]	○ ^H	○	○	○	○	○	○
Maximum no. of: Layers		333	10	1	128	256	1,024	31	1	256	256	1	21	256	None	140	16	Unlimited
Colors		8	7	16	16	256	12	15	1	1	16	1	16	15	10	None	8	Unlimited ^H
Pens		8	Plotter 1 dependent	16	256	16	None	2	8	16	1	16	8	8	8	5	8	16
Line types		8	10	10	5 pre-set lines; 95 user-definable	256	12	8	1	2	7	1	8	4	None	14	10	Unlimited
Hatching patterns		User-definable	None	None	1	Unlimited (5) [*]	146	None	User-definable	None	23	None	39	7	None	None	38	Unlimited
Lines per drawing		RAM-dependent	RAM-dependent	RAM-dependent	RAM-dependent	RAM-dependent	3 million	Unlimited	RAM-dependent	RAM-dependent	RAM-dependent	500 (items)	RAM-dependent	Unlimited	130	RAM-dependent	RAM-dependent (8,000 practical limit)	Unlimited

^H Indicates Editor's Choice ●—Yes ○—No * Numbers in parentheses refer to module numbers † Circles can be drawn only as arcs commands. ‡ For certain operations only. Most edit functions require selection view window § AutoLisp gives you the ability to access the Selection Set.

PLOTting CONTROLS

	Curve Digitizer	AutoSketch	CCS Designer	InterCAD	Generic CAD	LaserCAD	EasyCAD	EmuCAD	MATCAD	Drifts 1 Plus	Drifts 3D Modeler	ProDesign II	Cadkey I	Pro 3D/PC	ECAD Drafting Software	RAM-dependent (330K practical limit)	AutoCAD
Bytes per file	RAM-dependent	RAM-dependent up to 640K	RAM-dependent	318K	RAM-dependent	65 million	Unlimited	RAM-dependent	RAM-dependent	RAM-dependent	RAM-dependent	RAM-dependent	Unlimited	200K	RAM-dependent	RAM-dependent (330K practical limit)	Unlimited
Windows or views	1	None	1	1	1	1	4	1	1	16	4	1	Unlimited	7	None	1*	Unlimited
Symbol attributes	None	○	None	None	None	Unlimited	None	None	None	Unlimited	RAM-dependent	2,000	Unlimited	None	140	None	Unlimited

MISCELLANEOUS FEATURES

Freehand sketching	●	●	●	●	○	●	○	●	○	●	○	●	○	○	○	●	●
3-D	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Slide shows	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Screen menus	Programable	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Preset	●	●	●	●	●	○	●	○	●	○	○	●	●	○	●	●
Tablet menus	Programable	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Preset	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Function-key support	●	●	●	●	○	●	○	○	○	○	○	○	○	○	○	○	○
Command-line interpreter	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Command scripts	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Programming language	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Calculator	Algebraic input	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Registers	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
DOS shell	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Error messages	Plain language	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Numerical	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Imports IGS	○	○	○	○	(8)*	○	○	○	○	○	○	(1)*	○	○	○	○	○
Exports IGS	○	○	○	○	(8)*	○	○	○	○	○	○	(1)*	○	○	○	○	○
Imports DXF	○	○	(1)*	○	(1)*	○	○	○	○	(3)*	○	○	○	○	○	(3)*	○
Exports DXF	○	○	(1)*	○	(1)*	○	○	○	○	(3)*	○	○	○	○	○	(3)*	○

DOCUMENTATION

No. of pages	300	58	106	206	320	202	371	300	510	909	221	185	340	271	47	301	629
Index	○	●	○	●	●	○	○	○	○	○	○	○	○	○	○	○	○
Tutorial	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Quick-start chapter	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○

* Program operates under Windows. Other drawings can be opened, but multiple views of the same drawing cannot be displayed. ** In "tool mode only." †† A provided facility lets you enter information for use in a future release. ‡ Output through Drafts J Plus. § 16.7 million with AutoShade.

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| <input type="checkbox"/> Sigma Designs Color 400 | <input checked="" type="checkbox"/> Hercules |
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| <input checked="" type="checkbox"/> QDP VIVA 640/800/1000 | <input type="checkbox"/> AST Research AST-3G/Model I |
| <input checked="" type="checkbox"/> Paradise Auto SW EGA | <input type="checkbox"/> ATI Graphics Solution/EGA Wonder |

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CIRCLE 373 ON READER SERVICE CARD

■ LOW-COST CADD

unwanted lines. And since you can't delete these lines individually, you must delete all points and begin again.

While *CCS Designer* doesn't offer a grid function to help you locate the cursor position, it does let you specify 20 different cursor step sizes that act as a grid for aligning points.

SCALING *CCS Designer* has a neat feature for setting units. You can set two points anywhere on the screen, and the distance between them becomes one unit in your drawing; this scaling factor is then used in all distance computations in your drawing.

However, it would be nice to be able to say how many units fit into the specified distance. If I were doing a drawing of a building lot 200 feet wide, for example, I would like to set a point at each side of the screen and tell the program that this distance represented 200 units. This would fit the drawing precisely to the screen. Setting two points 1/200 of the screen width apart on the first try requires a bit more dexterity than I possess. Just to make sure that objects fit the screen the way you want them to, it is prudent to verify the dimensioning by setting points at extreme locations in the drawing before investing any further effort.

CCS Designer offers limited dimensioning capabilities. While it automatically draws arrows and distances between points, you must add extension lines manually. It does not offer associative dimensioning.

The package does not offer hatching, either. The only way to hatch a drawing is to draw each line individually, a tedious and time-consuming process. Though you can fill a drawing, the fill does not expand when you expand a drawing.

To select an entity for operations such as Copy, Rotate, Move, and so forth, you draw a box anywhere on the screen, and all of the lines, arcs, points, or other geometric figures inside the box can be treated as a single entity. The package, however, does not let you screen portions of the drawing for selection.

TESTING THE PRODUCT Drawing gear teeth with a program that does not let you specify arcs in terms of center, radii,

and angles is painful. I had to draw construction lines out from the center of the gear to locate the lines and arcs in the teeth, then delete them later. While I was able to use the Copy and Rotate commands to complete the gear after drawing just five teeth, this method was more time-consuming than necessary. A circular array feature, for instance, would have done the job much more quickly, as would a Mirror feature that allowed you to construct just half of the tooth and then mirror it over the axis.

Although *CCS Designer*'s redraw time, at 24.85 seconds, is in the middle of the pack, it's one of the slowest packages when it comes to deletion. This is because it deletes points one at a time rather than deleting the whole screenful at once.

AUTOCAD COMPATIBILITY *CCS Designer* offers a utility to translate drawings to and from DXF. I translated a sample space-shuttle drawing from *CCS Designer* format to AutoCAD format and back, with no change to the drawing.

IN SUMMARY *CCS Designer* is a very low-cost package, and you get what you pay for. It offers only the basic features and is somewhat difficult to use. While it might be adequate for floor plans, it is not recommended for mechanical engineering applications.—William Taylor

Curve Digitizer

Curve Digitizer, from West Coast Consultants, is a bare-bones, shareware product that offers the basic drawing, hatching, and dimensioning commands but none of the extras. Then again, if you can figure out how to use the program without the full manual, it cost only \$5. The 300-page manual can be had for \$49, and \$89 will get you the manual plus technical support. If you give a copy of your disks to someone who buys the manual, you get a \$15 commission. West Coast Consultants also offers optional libraries of common electrical symbols for \$10 and architectural symbols for \$15.

To use the program, you enter a function key that allows you to select a command group. A menu then pops up at the right side of the screen telling you what to do next. This makes learning the package



FACT FILE



Curve Digitizer,
Version 3.0
West Coast Consultants
4202 Genesee Ave.,
#309

San Diego, CA 92117
(619) 565-1266

List Price: \$5, including software and documentation on disk; manual, \$49; Registration Package, including manual, phone support, and free updates for one year, \$89; Electronic Symbol Library, \$10; Architectural Symbol Library \$15.

Requires: 256K RAM, two disk drives, DOS 2.0 or later.

Supports: Hercules monochrome graphics card or compatibles; IBM CGA, EGA, or compatibles; Microsoft Mouse or compatibles. Houston Instrument HiPAD DT114 and True Grid. Dot matrix printers, plotters.

In Short: An unbeatably priced and capable, though limited, two-dimensional drawing program. Not copy protected.

CIRCLE 648 ON READER SERVICE CARD

easy enough to accomplish without the manual.

Curve Digitizer's commands are mnemonic. For instance, to begin drawing a line, you type L, move the cursor to the end of the line, and enter L to draw a line between the two points. You draw boxes by entering the B command and specifying two corners, and so on. Each command prompts you for each point it needs.

The package lets you draw lines, points, circles, arcs, rectangles, polygons, polylines, and text. Its commands include Snap, Unerase, Move, Copy, Mirror, Rotate, and Layers. The package, however, lacks such features as arrays, fillet, chamfer, and undo. Though it does not offer a grid feature per se, *Curve Digitizer* does allow you to specify a cursor step size. By setting the step size to a given amount, you can make sure that points are placed evenly.

You can specify points in either absolute or polar coordinates. Current coordinates are displayed at all times. *Curve Digitizer* stores these points in an ASCII text file that you can edit with a word processor or with the program's Editdata utility. Although the point file is currently stored in a proprietary format, West Coast Consul-



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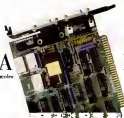
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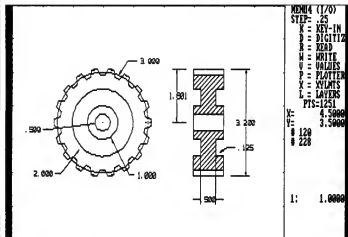
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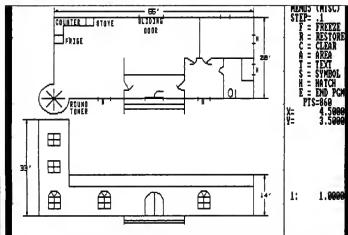


CIRCLE 252 ON READER SERVICE CARD

■ LOW-COST CADD



Because Curve Digitizer can only perform operations such as Copy on objects composed of contiguous points, you must place points carefully. You draw the teeth either by calculating the position of each point or with the help of construction lines. After drawing five teeth, I created the remaining teeth by copying them over the axis.



Drawing this architectural plan with Curve Digitizer was tedious. I had to figure out the x and y coordinates for every endpoint in each wall, door, and window before drawing the lines connecting them. It was difficult to locate the door swings because this required locating the endpoints of the arc so that it passes through the endpoints of the door.

tants is working on a utility to translate to and from DXF files.

Curve Digitizer is unusual in that it stores the coordinates of all the points de-

fining entities in the order in which you enter them. To select an object, you must specify the numbers of the first and last points in the object. You can rotate, scale,

move, or change the color of lines linking these points. In contrast, AutoCAD's entity selection capabilities are far more sophisticated. AutoCAD lets you choose entities individually, by screen area, and by including or excluding various types of entities from a selected window.

Curve Digitizer stores symbols in separate DOS files. This method, unfortunately, fragments your file directory.

Whenever you need to copy a symbol into a drawing, you select the symbol's file. The program opens the file, reads all the points, and appends them to your drawing file. Because symbols are composed of contiguous points, you can cause them to rotate, scale, move, or be copied wherever you want them.

Curve Digitizer has a convenient utility for hatching any enclosed area in a drawing. However, if there is an enclosed area inside the area you are hatching, the hatching does not bleed into the inner area. To use the hatching feature, you select a series of contiguous points to define a closed curve, then specify hatch line angle and spacing. The program generates the lines to hatch the area bounded by lines connecting the specified points.

Hatch lines take up a lot of memory, so Curve Digitizer lets you write hatch lines to a separate file and encourages you to put them in a separate layer of the drawing to keep from overflowing memory.

Curve Digitizer generates automatic dimension lines, arrows, and text. To start a dimension from the menu, the program asks you for the first point, the endpoint, and the location of the arrow line. Once Curve Digitizer draws the extension lines it arrows, and computes the size of the dimension based on the distance between the points. You can override the automatic dimensioning by retyping the text.

BAD HABITS Curve Digitizer has some very annoying habits. For instance, you must specify the disk drive each time that you wish to load or store a file. However, the package does display all the files in the directory for you to look at while you enter a name and supplies an appropriate extension.

The package has neither zoom nor pan features; and, if you wish to move a drawing around the screen, you must change all

■ LOW-COST CADD

of its coordinates (without redrawing it). *Curve Digitizer* also can't define an arc by its center, radius, and starting and ending angles.

DOCUMENTATION The documentation offers a good set of diagrams that show the keyboard for each group of commands, as well as a composite diagram that shows all the command names. But it has no index. Unless you know what the command you want is called, you'll have a hard time figuring out how to accomplish something. Once you learn the name of a command, you can use the diagram to locate its explanation in the manual; fortunately, the menus are good enough to make frequent lookups in the manual unnecessary.

TESTING THE PRODUCTS Because of the nature of the entity selection process, I had to think carefully about the order in which I drew the gear teeth in the trial drawing. Drawing them was tedious since I had to calculate the position of each point by hand. Since my trigonometry is rusty, I located the teeth by directing construction lines 1.6 inches long out from the center of the gear and angled at the center of each gear tooth. I entered these lines via polar coordinates. When these lines were in place, I put in another set 1.24 inches long that pointed to the bottoms of the teeth. I drew all the lines at once so that they could be selected as a contiguous group and deleted after the teeth were drawn.

Once I knew where to put them, I was able to draw the first five teeth reasonably quickly. I could then select all the points in the teeth, and copy and reflect them around a vertical line passing through the center of the gear. This gave me the top half of the gear. Next, I selected those teeth and reflected them around a horizontal line through the center of the gear to create the remaining teeth. I then selected the construction lines and deleted them.

Drawing the architectural plan was a straightforward but also somewhat tedious. I first figured out the x and y coordinates of every point in each wall, door, and window in the drawing; then I drew lines between the points by typing in the x and y coordinates. The arcs for the doors were the most painful to draw because it took

several tries to locate the endpoints of the arc so it could run through the end of the door.

Curve Digitizer was one of the slower packages when it came to screen redraw time. Deletion time, at 26 seconds, was about in the middle of the pack.

IN SUMMARY All in all, *Curve Digitizer* is a capable, basic drawing program with a number of deficiencies that would make it unacceptable for production drawing, but it is adequate for the casual user. And the price is unbeatable.

—William Taylor

Drafix 1 Plus

At \$1,000 *Drafix 1 Plus*, from Foresight Resources Corp., would be a great buy. At its retail price of \$295, it's a steal. Because it's easy to use and because it requires confirmation of all its commands before entry, the package seems geared toward the novice or casual user. Yet it offers most of the features commonly found in more-expensive packages, as well as an extensive symbol library. The only significant feature it lacks for production drawing is a macro language.

Drafix 1 Plus has a bevy of features that include everything from the traditional to the rare for CAD packages in this price range. It has tangents, offsets, and rectangular and circular arrays; and, unlike most products in the under-\$500 range, it includes a command for parallel lines. That command fixes corners as it draws the lines, though it doesn't clean up parallel-line intersections.

You'll find most grids except for rotated and isometric ones. And you can snap to any of these grids as well as to line intersections and midpoints, to the center of a circle or arc, or to the nearest entity.

You can form an isometric construction by using a command that takes an orthographic view and "stretches" it automatically into one of the isometric sides. This works much better and faster than any other construction command I have ever seen.

Drafix's sketch mode, which resembles that of *AutoCAD*, differs from that of most other CADD packages in this price range. While comparably priced CADD packages create and display free-form curves as



FACT FILE

drafix
plus

Drafix 1 Plus,
Version 2.0
Foresight Resources
Corp.

932 Massachusetts Ave.
Lawrence, KS 66044
(913) 841-1121

List Price: \$295; Large

Plot software, \$150; Dot Plotter, \$45; OTTO

(DXF import/export program), \$95; General

Symbols Library, \$80; Professional Archi-

tectural Symbols Library, \$150; Professional

Electrical Symbols Library, \$150; Professional

Mechanical Symbols Library, \$150.

Requires: 512K RAM, two disk drives (hard

disk recommended), DOS 2.1 or later;

8087/80287 math coprocessor recommended.

Supports: Amdek 1280; AST-3G Plus; ATI

Wonder; AT&T 6300; Conographics 40;

Hercules monochrome graphics cards and

compatibles; IBM CGA, EGA, and compati-

bles; Micro Display Systems Gemini; Mylex

AGA, NEC GB-1; Orchid Turbo EGA; Paradise

AutoSwitch; Quadram EGA Pro-Synch; Sigma

Design Color 400; STB Chameleon and

STB 400; Tuxton TEGA 560; Tseng EVA

480; Video 7 Vega and Vega Deluxe; Wyse

WY-700; AT&T Mouse; Microsoft Mouse

and compatibles; Calcomp 2500; GTCC Micro

Digi-Pad; Hitachi Tiger Pad; Houston In-

strument HIPAD; Kurta Series One; Mitsubishi

Graftec; Numonics 2200;

Summagraphics MM Digitizer Series and

SummaSketch; Tandy GT2000. Dot matrix

and laser printers; plotters.

In Short: A fast, easy-to-use, extremely full-

featured package. About the only thing missing

is a macro language and programming

capabilities. Not copy protected.

CIRCLE 604 ON READER SERVICE CARD

a series of tiny line segments, a process that gives curves the jaggies, *Drafix* offers true free-form sketching. Though free-form curves are initially created as a polyline, you can convert them to a true spline. Bezier curves are not currently supported.

Absolute, relative, and polar/relative construction modes are available.

You can fill your drawings with one of the 15 available hatch patterns. While these patterns are not user-definable, you can control the angle and spacing of the patterns. Anything that can be grouped can be hatched.

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*The evaluation version of Microsoft Word 4.0 is limited only by the size of the file you can create. It does not include the spellchecker or thesaurus available in the full version of Word 4.0.

A report detailing the benchmark tests, their methodology and hardware systems is available, at no charge, by calling 1-800-541-1261, Dept. A90.

Tests were performed by an independent testing organization on a Compaq Deskpro 286 (8 MHz), 640K RAM and



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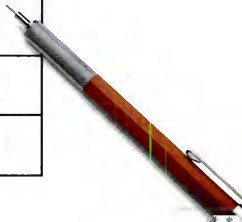
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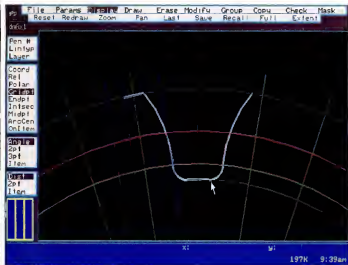
Seconds

Scroll by line (b)	Search + replace (c)	Delete 100 characters
17.7	4.1	1.7
38.5	6.0	10.7
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76.2	5.9	5.0

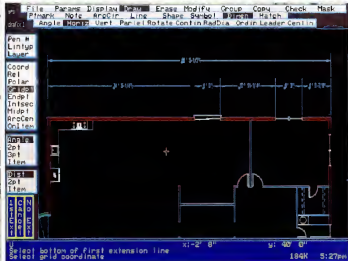
on EGA graphics adaptor. a = 9 page document, b = 480 lines, c = 287 words



■ LOW-COST CADD



Drafix made the gear construction simple. We drew the blue parallel lines to help with construction, then used the fillet function to draw the curve at left. We mirrored that curve over the center line and connected the mirror images. To finish the gear, we would simply use a single circular-array command.



Unusual among packages in this price range, Drafix's parallel-line feature makes construction of architectural drawings easy. The parallel-line feature would be more useful, however, if it automatically cleaned up intersections. In this drawing, you can see the dimension and witness lines.

tation, though you cannot add other fonts or change the existing fonts in any other way. Notes can be edited and justification changed quite easily; text editing is done with a pop-up text editor.

EDITING *Drafix's* editing features are also extensive. You can trim, extend, scale, and stretch objects, though you can't drag them. Symbols are aligned by selecting a placement point and orientation. You can move and copy objects by specifying the points you want to move to and from. Or you can choose rotation angles from existing objects. Partial deletion is allowed, but only if you break or divide the entity first.

The package has a useful function that allows you to group objects together for editing, moving, saving, or other functions. You can add objects to a group individually, add a string of objects linked together, or add objects by region. The latter option is a powerful selection tool that allows you to pick and choose the objects you want to include in a particular window. You can choose to include or exclude some or all objects that are partially included in a window; likewise, you can include and exclude objects by type (points, lines, arcs, symbols, shapes, or notes), pen color, layer, or line type.

The group function's one quirk is that you can use edit commands either on a group or on a selection, but not on both. If you wanted to mirror a drawing that contained both, you'd have to use two steps.

Drafix's Undo command is an unerase feature that backsteps through the last three erasures. But since you must confirm your every action, the need for an Undo command is minimal.

The display/zoom mode in *Drafix* is different from nearly all others. Rather than selecting a corner of the desired area, you locate its center. You then move the cursor to indicate the appropriate area around that center point (rather than the second point of the box). Next you choose to either make that area fit the screen (zoom in with the mouse, left button) or make the screen fit into that area (zoom out with the mouse's right button). This method worked fine in most cases.

Panning is accomplished by the "from/to" method: you select the point on

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■ LOW-COST CADD

the screen that you want to move from and then select a destination point.

DIMENSIONING *Drafix* offers all of the common dimensioning units, including metric, English, and decimal; linear and angular dimensions are also available. While many low-cost CADD packages offer just 1 or 2 line terminators, *Drafix* gives you 23, including arrows, slashes, and crosses, although you cannot define your own. Although *Drafix* handles baseline and stacked dimensions, it lacks associative dimensioning.

You can have a great deal of control over dimensions by defining their position, witness lines, and minimum leader length. While tolerance dimensioning to indicate degrees of error is not supported, the symbols for tolerance, and degrees, as well as those for phi, mu, and omega, are available in text. *Drafix* will also compute the area and perimeter of an entity.

USER INTERFACE *Drafix* has an excellent user interface. Because it requires confirmation for each command, it's great for the new or occasional user. The program has three 1-2-3-type moving-bar menus on the upper portion of the screen that you access only with a mouse or other pointing device. This method is slower than using drop-down menus because you must move your mouse back and forth between the menus. On the left of the screen are additional drawing commands, some of which (the snap mode modifier commands) you can access with the keyboard. Hence you can enter keyboard commands with your left hand, which frees you to enter mouse commands without requiring you to take your right hand off the mouse.

The program also offers so-called parenthetical or interrupt commands that allow you to begin a command, then zoom to another portion of your screen before completing it.

SYMBOLS *Drafix* offers several optional symbol libraries, or you can create your own. The available options are a General Symbols Library for \$80 and, for \$150 each, a Professional Architectural Symbols Library, a Professional Electrical Symbols Library, and a Professional Mechanical Symbols Library.

Symbols are also easy to create. You can save symbols locally (in a particular drawing) or globally (as a file on disk that you can copy into other files). There is no limit on how many symbols you can nest, one within the other. You size symbols prior to placement, then orient them as you place them. Each symbol is stored only once with the drawing; subsequent placements then refer to the original symbol. You may edit or partially delete symbols only if they are exploded first.

The one drawback to the *Drafix* symbols is that they can take up more storage space than necessary, since each symbol is stored as an individual file, rather than being grouped into a library file.

TEST RESULTS Because *Drafix* has nearly all of the features found in *AutoCAD*, creating all of the test drawings was a snap. After constructing half of the gear tooth, I was able to use the mirror feature to complete the tooth. The radial array feature allowed me to copy the one tooth around the circle in an instant. Rescaling the gear was easy with the scale and stretch commands.

The architectural drawing was also easy to construct. Unlike most of the other packages reviewed here, *Drafix*'s parallel-line function allows for easy construction of walls, though the package did not automatically clean up the intersections between walls.

In the PC Labs performance tests, *Drafix*'s 9.6-second redraw time and its 4.7-second delete time made it one of the fastest packages tested.

KEEPING HOUSE The size of *Drafix* files is limited only by the size of your hard disk. But since *Drafix* stores drawings in RAM as you create them, the drawings are limited to approximately 230K, or about 8,000 entities. The database is a binary file, and the data is in floating point.

Drafix's documentation is excellent, with the notable exception of the tutorial, which is difficult to follow, boring, and outdated. Actually, that doesn't matter much because *Drafix* is extremely easy to use, and the phone support is excellent. The documentation could also benefit from using plotted drawings rather than screen dumps.

Installing the program is a snap. Just place the appropriate disk in drive A:, type **INSTALL**, and the drive name (C: is the default), and follow the instructions on-screen. Setup is easy enough to be understood even by a first-time user.

In all, *Drafix 1 Plus* is a full-featured professional tool that happens to cost less than it should. Its designers have come up with a program that could (and probably will) take *Drafix* into direct competition with the "big boys" in the PC market—*AutoCAD*, *Cadvice*, and *VersaCAD*.—W. Bradley Holtz

Drafix 3D Modeler

Drafix 3D Modeler, which was originally from MegaCADD and is now distributed by Foresight Resources Corp., may not be the right package for serious CADD applications, but it's a great tool for helping you visualize designs in three dimensions. Not only that, this \$295 program is fun to use!

Foresight also sells *Drafix 1* and *Drafix 1 Plus*, and though you can purchase either of these products separately, they seem designed to work in tandem with the 3-D package.

You can use *Drafix 3D Modeler* as a standalone, but you need one of the other two packages for CADD functions. For instance, *Drafix 3D Modeler* offers no features for dimensioning or calculating distances, for crosshatching or shading surfaces, for specifying the color of elements, or for entering text. Instead, you must dump your drawings into one of the other packages to obtain those functions. (You can only export to those packages, since *Drafix 3D Modeler* supports neither DXF or IGES formats.) In addition, since *Drafix 3D Modeler* does not support any kind of hard-copy output, you must dump to *Drafix 1* or *1 Plus* for printing.

Drafix 3D Modeler is extremely easy to use: all pertinent menus remain on the screen at all times. Portions of the menus change as you select various functions, and the package leads you, most often painlessly, through the input required for each function.

To construct a 3-D object, you place a figure in a two-dimensional plane. The object may be a square, rectangle, circle, polygon, or multisided free-form shape.

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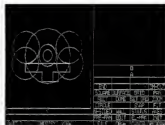
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■ LOW-COST CADD



We constructed the 3-D test object in two pieces. At left, you can see the process used to create the first piece. First, we drew the shape in a two-dimensional plane. We then projected the object into three dimensions (you can see up to four views of an object at one time). We repeated the process to form the second portion of the test object. As shown in the screen below, we merged the two files into one wireframe object.



The completed 3-D test object is shown here in perspective. We also hid the appropriate wireframe lines. Creating this image was a simple process. This series of four screen displays shows that all the necessary menus remain on the screen at all times, with pertinent portions changing as you select various functions.



EDITOR'S
CHOICE

FACT FILE

drafrix

Drafix 3D Modeler,
Version 1.01
Mega CADD
Distributed by Foresight
Resources Corp.
932 Massachusetts Ave.
Lawrence, KS 66044
(913) 841-1121

List Price: \$295

Requires: 512K RAM (640K RAM recommended), two disk drives (hard disk recommended), DOS 2.1 or later, 8087/

80287 math coprocessor recommended.

Supports: Amdek 1280; AST-3G Plus; ATI

Wonder; AT&T 6300; Conographics 40;

Hercules monochrome graphics card and

compatibles; IBM CGA, EGA, and comput-

ables; Micro Display Systems Genius; Mylex

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disse AutoSwitch; Quadram EGA Pro-Synch;

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and compatibles. Calcomp 2500; GTCO Mi-

cro Digi-Pad; Hitachi Tiger Pad; Houston In-

strument HIPAD; Kurtz Series One; Mitsubi-

shi Grafnet; Numonics 2200;

Summagraphics MM Digitizer Series and

SummaSketch; Tandy GT2000. Dot matrix

and laser printers or plotters (all via *Drafix I*

Plus).

In Short: An easy-to-use 3-D modeling

package. This package offers none of the

typical CADD functions, such as hatching,

dimensioning or calculating distances, or

even plotting. For any of these functions, you

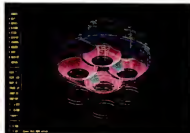
must import your files into *Drafix I Plus*. Not

copy protected.

CIRCLE 642 ON READER SERVICE CARD

You can also create domes, walls of varying thickness or no thickness, and curved surfaces.

You then project your 2-D object into the third dimension so that the circle becomes a cylinder, the square a cube, and so on. You simply locate the cursor where you need it (snaps to the alterable grid or to an existing object are supported) or enter the absolute coordinates, and the objects spring into three dimensions right before your eyes. *Drafix 3D Modeler* also gives you a full set of editing features for altering these objects: you can transform cubes into pyramids, bend surfaces, move points and whole objects, or stretch and scale elements, all in three dimensions.



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■ LOW-COST CADD

The package gives you up to four views of your object on the screen at a time. Both the create and the view modes show you a top or xy-plane view, and a perspective view from the selected perspective. When you place a square in the top view, you will see the resulting cube pop up in the corresponding perspective view. You can specify the flat drawing plane to be either yz or xz. The modify mode shows four windows: xy, xz, yz, and perspective. You can use any of these windows to grab a point or element and modify it.

The views generated are wireframe views; that is, you can see right through a wall or object as if it were made of wires placed at the edges of the elements. But *Drafix 3D Modeler* also allows you to hide the wireframe lines to get a truer picture of the object. The two available algorithms for determining which lines are to be hidden take some time to generate the view. And even in two dimensions, *Drafix 3D Modeler* is relatively slow. It took the package 25.8 seconds to complete PC Labs redraw performance test; only three other packages were slower. As you might imagine, *Drafix 3D Modeler* would be helped considerably by a math coprocessor, and an AT is recommended.

THE TEST DRAWINGS We were able to draw the assigned three-dimensional gear with few problems. We then examined it from all angles—top, left, right, below, front, isometric, and (hold on to your seat) from the inside out.

After creating the two-dimensional house plan, we decided to translate it into three dimensions. This wasn't difficult to do: we placed walls where they would have been in a two-dimensional plan and then gave them height. We added a few features like doors, kitchen cabinets, a refrigerator, and windows. We entered previously drawn bathroom fixtures as symbols. Then we took a look at our creation. How does it look from the foyer, looking toward the study? We simply went into view mode, placed our eye 5 feet off the ground in the foyer, and specified the view direction and height. Voilà! The program generated the view.

Oops! We forgot that strange tower on the front corner. No problem: just extend a circle up into the air for the tower. Then

put another circle on top of the first one and collapse the top to a point to make a neat conical roof. Now how does it look coming up the drive? Or from 50 feet in the air? *Drafix 3D Modeler* lets you see it from any vantage point.

The manual is very readable; it takes the reader through the fundamental concepts of three-dimensional design, and then gives technical information about each menu command in each of the three modes. It is well illustrated, with drawings that really help the user understand what is going on. While there is no reference manual per se (the features are introduced in a tutorial fashion), the index is useful for finding information about a command. We were never at a loss as to how to proceed.

Will *Drafix 3D Modeler* replace *AutoCAD* as the CADD package of choice? No, because the two packages address two independent issues. *Drafix 3D Modeler* is for visualizing objects in three-dimensional space; *AutoCAD* is for creating technical drawings. There is a need for both kinds of products, and anyone modeling real-space objects would benefit from *Drafix 3D Modeler*—it's powerful, user friendly, and downright fun to use.—Donald C. Peckham and Martin L. Ramsey

EasyCAD

EasyCAD is suited for the casual CADD user who needs an inexpensive (\$169.95) CADD package that offers a wide range of commands and is easy to learn. The trade-off for low price is that *EasyCAD*'s commands are not as flexible as those offered by a high-end package like *AutoCAD*. Yet, surprisingly, *EasyCAD* is also programable. You can now obtain the package bundled with Microsoft's new mouse for \$175.

User interface is *EasyCAD*'s strongest feature. The menus allow the user to become proficient quickly. You can enter commands from the keyboard or a mouse.

EasyCAD's sophisticated programming language allows you to change the program's menus, to assign commands to function keys, and to program macros. In fact, the language is similar to *AutoCAD*'s AutoLISP, and those who are familiar with the process of altering *AutoCAD* menus will find the process of changing



FACT FILE



EasyCAD, Version 1.08
Evolution Computing
437 South 48th St
Tempe, AZ 85281
(602) 967-8633
List Price: \$169.95
Requires: 256K RAM,
two disk drives or hard
disk, DOS 2.0 or later, 8087/80287 co-
processor recommended.

Supports: Hercules monochrome and Int'l-
card, HP 8290A graphics controller,
IBM CGA, EGA, VGA, or compatibles; Ma-
trox PG640 and PG1280; Number 9 Pepper
Pro 1280; Sgi Board, and 2048 x 4 board;
Paradise Systems EGA 480; Pixel Works
Clipper; Sigma Designs Color 400; TecMar
Graphics Master; Tseng Labs EV 440; Vec-
tex Midas graphics card; Video 7 VEGA De-
luxe; Verticon H16 and H-256 boards; VMI
Image Manager and Cobra. Macrosoft
Mouse or compatibles. Call Comp 2500;
GTCC DigiPad Type 5A; Hitachi Tiger Tab-
let; Houston Instrument True Grid; Kurta Se-
ries One, Two, and PenMouse; Numonics
Model 2200; Mitsubishi GrafNet Model 01
and Pentel Series; SummaGraphics BitPad 1,
BitPad 2, and SummaSketch. Dot matrix and
laser printers; plotters.

In Short: A very easy-to-use package with a
number of sophisticated features including a
programming language, macros, associative
dimensioning, and a useful Drag command.
For \$175, *EasyCAD* comes bundled with Mi-
crosoft's new mouse. Not copy protected.

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menus and function-key assignments easy. *EasyCAD*'s macro language is rudimentary, but can accept numeric input from the keyboard.

EasyCAD includes good commands for simple geometric construction. Besides the basic shapes such as lines, points, circles, arcs, and polygons, you can build more-sophisticated features such as splines, parallel lines, perpendicular lines, or lines intersecting at specified angles. Tangents are not provided for.

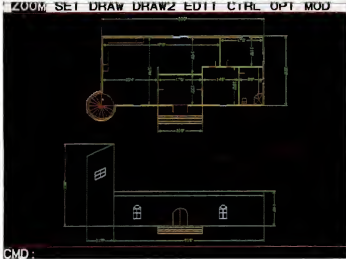
EasyCAD offers two fonts for labeling drawings—standard and fancy—which you specify when you plot the drawing.

You can enter absolute, relative, or polar coordinates. Floating-point precision is supported.

EasyCAD offers rectangular grids and snaps at any spacing, although the spac-



EasyCAD lacks such features as hatching, polar arrays, and radial dimensioning, so drawing the gear was difficult. To position the teeth, it was necessary to create construction lines. After inserting several teeth, I used the Mirror command to complete the gear. I was also required to dimension the gear and gear detail by hand.



Drawing the house with EasyCAD was a straightforward process. Using the Drag command, it was simple to resize rooms after they were redimensioned. Because the dimensioning label commands were not very flexible, the final drawing was not as attractive as it might be. And because EasyCAD has no symbol library, all details had to be constructed by hand.

ings are always the same for the horizontal and vertical axes. You can snap to endpoints, centers, and midpoints. In addition, the Attach command lets you snap to the nearest point on an entity, though it is difficult to predict the exact point to which it will snap. The snap features are particularly handy because they operate from within entity commands; you don't need to exit from an entity command to use them.

The Drag command is incredibly useful. With it you can shift the position of an entity, and the program will automatically make appropriate changes in adjoining entities. For instance, if you drag an interior wall, its intersection to adjoining walls will be cleaned up and the corresponding dimensions will change. The Drag command, however, is not animated, so you have to redraw the screen each time you use it.

The Connect command is also unique. You use it to move, scale, and rotate one entity to fit other entities. For instance, if you have an arc and a polyline located on separate parts of the display, you can specify the two points on the arc you want the polyline to fit into, and the Connect command will move and scale the polyline to fit into the arc.

The package does offer an Undo command, but though the command will erase an unwanted entity, it will not undo the last command entered. For example, if you added a line, then chose Undo, the program would erase the line. But if you erased a line, then chose Undo, the line would not reappear.

The selection mode is simplistic. *Easy-CAD* limits your selection to those entities having an endpoint in the window. This is the only selection criterion, and there is no way to change it.

To group entities, you define them (collectively) as a part. If you wish to remove the grouping, you can choose to do so either temporarily—in case you wish to re-use the symbol—or permanently.

It was surprising to find associative dimensioning in such an inexpensive package, but the dimensioning was otherwise limited. You can dimension only horizontal, vertical, and parallel lines; angular or radial dimensions were unavailable. The lack of an Arrow command is also inconvenient. Another drawback is that the lead-

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A Resource to Draw Upon



To get any job done, you need the right tools. Ideally, they should be extensions of your talents, freeing you to do what you do best. And speed, precision, flexibility, and consistency are always top priorities, no matter what the job. If communicating with drawings is part of your job, AutoSketch should be one of your resources.

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Despite its ease of use, AutoSketch is a full-function, object-oriented CAD program. Pull-down menus and dialog boxes help you each step of the way. With a click of the mouse, you can draw, then copy, mirror, or move objects, even create symbol libraries. AutoSketch automatically updates measurements whenever you stretch, scale, or rotate dimensioned objects. It even keeps track of everything you do, so that you can delete and restore parts of your drawing as easily as you change your mind, using successive undo or redo commands.



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Call 800-445-5415 for the name of the AutoSketch Dealer nearest you or more information on supported peripherals. To order direct with a credit card, call 800-223-2521.



er lines for the dimensions always begin where you take the dimension; consequently it was easy to wind up with long leader lines that overwrote other leader lines.

Specifying units of measure was confusing and frustrating. *EasyCAD* measures only in program units; you can set one unit as equal to an inch, foot, meter, or millimeter. But you must remember to choose your units before you begin drawing. It is easy to forget to set units, and the only way to tell what a unit represents is to use the Status command. If you forget to specify the proper units, you'll often wind up with drawings that are either 12 times larger or 12 times smaller than expected.

OUTPUT *EasyCAD* imports and exports DXF files, but you must use a separate conversion utility. The process is simple and seems to produce good results. *EasyCAD* does not translate IGES files.

Plotting is done through another separate Plot utility. It is simple to use but does not allow options beyond selecting the view you want to plot and the scaling.

GEAR DRAWING Because *EasyCAD* lacks features such as hatching, polar array, and radial dimensioning, drawing the gear was difficult. Hatching by hand was incredibly time-consuming. And without a polar array feature, I had to create construction lines resembling wheel spokes and use them to position the teeth, which I then made into symbols (or "Parts") and inserted. After inserting several teeth, I used the Mirror command to complete the gear.

Because the package lacks a radial dimensioning feature, I had to dimension the gear and gear detail by hand. Circle dimensioning is not associative. When increasing the size of the circle, I therefore had to change the text next to each arrow line. I also had to construct arrows by hand, since *EasyCAD* cannot generate arrows for circles. And when the dimensioning text does not fit inside the leader lines, *EasyCAD* does not automatically put the text outside the lines (see the gear drawing); therefore some lines overwrite others.

The profile view of the gear was much easier to dimension, since it required only horizontal and vertical dimensioning.

When I increased the size of the gear, these dimensions changed automatically.

HOUSE DRAWING The process of constructing the house drawing was fairly straightforward. The Drag command made it easy to resize rooms even after they were dimensioned. Yet the final drawing would have been more attractive had the package contained more-flexible dimensioning commands. And since the package has no symbol library, you must construct all details by hand.

■ *EasyCAD's* Connect command is unique.

You use it to move, scale, and rotate one entity to fit other entities.

INSTALLATION *EasyCAD's* manual is excellent. It is clearly written and well illustrated. The tutorial is rather long but very helpful. A "General Concepts" chapter explains coordinates, angles, and CADD terminology to the beginning user, and the technical support department at Evolution Computing is very helpful.

Installation is simple and straightforward. After you type Install, the program leads you through the device choices.

The package supports most common peripherals such as tablets, printers, and plotters. *PostScript* devices are also supported as output devices.

If you decide to change devices, you'll need to reinstall the package, which means you'll have to haul out the Install and Device Driver disks (until you learn to circumvent the install routine). Only the necessary driver files are copied onto the *EasyCAD* directory. While this saves disk space, it makes device changes inconvenient. The install routine does not change *AUTOEXEC.BAT* or *CONFIG.SYS*, although you need to add file and buffer specifications to the *CONFIG.SYS* file.

EasyCAD comes on three disks, one of which includes sample drawings. It re-

quires about 350K bytes of disk space. The help file occupies about 90K. After I loaded a mouse driver and *EasyCAD*, 370K bytes of RAM were still available.

A math coprocessor is not required to run *EasyCAD*, but it is impractical to use the package without one. With the coprocessor, the package is relatively speedy. With a redraw time of 9.6 seconds and a delete time of 8.74 seconds on the PC Labs performance tests, the package was among the faster products tested. Spline curves, however, take a toll on program speed.

There is no automatic save, so a sudden power loss will cause you to lose any changes made since the last save.

SideKick worked with *EasyCAD*, although it left garbage on the screen and changed the appearance of colors. *POP-note* did not work.

EasyCAD does not measure up to a package like *AutoCAD* for the serious production user. Its commands lack the flexibility of those in *AutoCAD*, but then, *AutoCAD's* commands are incredibly flexible—for instance, *AutoCAD* has more than five kinds of zooms.

EasyCAD does offer a sophisticated programming language and macros. An occasional user with simple drawing requirements will be able to use *EasyCAD* quickly and will be happy with the range of editing functions, which include associative dimensioning and the very useful Drag command.—Mitzi Fox

ECAD Drafting Software

First impressions are hard to overcome, but after working with *ECAD Drafting Software*, the \$489 package from Pelton Engineering earned my grudging respect.

When I first dug into *ECAD*, I was put off when I found no tutorial, no help screens, no error messages, and a cryptic menu. Figuring out how to use many of the commands requires trial and error. For example, *ECAD* has no explicit way to draw curves. You must create curves from circular arcs, first specifying a starting point, an ending point, and the radius.

When I finally got the program going, I found that it offers much to like. Its four

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■ LOW-COST CADD



FACT FILE

ECAD

ECAD Drafting Software, Version 8.1
Pelkon Engineering Ltd.
3991 Smuggler's Cove Rd.
Victoria, B.C., Canada
V8N 4M1
(604) 477-8126

List Price: \$489 (U.S.)

Requires: 640K RAM, two disk drives or hard disk, 8087/80287 math coprocessor, DOS 2.1 or later.

Supports: Hercules monochrome graphics or compatibles; AT&T/Olivetti monochrome graphics board or compatibles; Microsoft Mouse or compatibles; GTCO Digi-Pad Type 5A, Kurta Series One and Two, SummaSketch. Dot matrix and laser printers; plotters.

In Short: A fast and versatile package with plenty of power but few frills and a manual that only an engineer could love. Not copy protected.

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Creating the architectural drawing was fairly straightforward with ECAD. The package offers seven snaps, and zooming and panning are fast. The presence of the cursor readout on the screen at all times, as well as the displayed scale and grid size, makes it easy to draw an object to exact scale, then auto-dimension it and measure any entity.

basic on-screen menus, which appear along the bottom of the screen and offer 37 options, are much easier to understand and use than those of AutoCAD. The way the commands are grouped in the menus is logical, with most of the drawing, setup, and editing commands linked in the respective menus.

Vertically arrayed along the right side of the screen is a list of additional commands and settings, detailing key information. The line thickness and pattern, arrowhead type, text size, cursor input method, coordinate type, and zoom ratio appear here. Also shown are such flag settings as mirror, cut, and remove.

A status line just above the menus at the bottom of the screen displays the current scale, how full the top layer of the drawing is, the grid rotation, and the x-y coordinates of the cursor.

TAKE A NUMBER Installation is a snap. You simply make selections for printers, mice, tablets, digitizers, and so forth. Select a number, and a screen displays the available choices. Once you've made your choice, you're immediately returned to the main menu, which reflects the update and awaits your further choice.



ECAD requires you to learn much by trial and error, which made the gear drawing particularly difficult. For example, you'll find in the manual no mention that you can't trim circles, ellipses, arcs, and fillets; nor can you erase a circle, arc, or ellipse. In addition, you can't make a fillet between an arc and a line or with another arc.

However, some choices are limited; for example, Version 8.1 supports only Hercules monochrome and AT&T/Olivetti

monochrome graphics.

During operation, you can make separate directories for all the drawings in a



Performance Tests: Low-Cost CADD

Our performance tests measure the time it takes for these packages to perform two frequently used CADD functions: screen redraw and deletion. They also record the size of a typical file. We performed the tests on an 8-MHz IBM PC AT with a standard 30-megabyte hard disk drive, an 80287 math coprocessor, and a Quadram Prosync Card outfitted with 256K of video RAM.

Performance Times

(Times given in seconds)

	File Size (K bytes)	Redraw	Block Delete
TurboCAD	162	43	288
ProDesign II	132	25	226
CCS Designer	62	18	35
Curve Digitizer	149	57	26
ECAD Drafting Software	9*	43†	21
AutoSketch	30	32	20
EntekCAD	38	19	16
Generic CADD	33	18	9
EasyCAD	26	10	8
LaserCAD	34	11	7
Cadkey 1	51	10	7
Drafix 1 Plus	18	10	5
AutoCAD	49	18	5
MATC CAD	45	8	5
In'a'Vision	29	7	0.3
Drafix 3D Modeler	62	26	N/A‡
Pro3D/PC	N/A§	N/A§	N/A§

We measured the **File Size** for the full ten-by-ten-entity array. These sizes ranged from 9K to 162K. A number of factors effect the file size. *Curve Digitizer*, *CCS Designer*, and *EntekCAD* store files as text rather than as binary files, which causes larger-than-normal file sizes. The number of points necessary for defining an object, the layout of the stored information, and the resolution of the data point specifications are other factors that influence file size.

The **Redraw** test measures the time it takes to redraw the full array on the screen by zooming to a full-page view and centering the array on the page. The results ranged from 7 to 57 seconds, with the median score registering 19 seconds.

The **Block Delete** test measures the time it takes to delete the bottom half of the array

using a single block delete operation. We did not include the time taken to select the block. *TurboCAD* and *ProDesign II* took 162 seconds and 132 seconds, respectively, to do the deletion because they removed each line one at a time. *In'a'Vision*, on the other hand, removed all selected objects at once and replaced the grid pattern over the deleted area, taking a fraction of a second to complete the process.

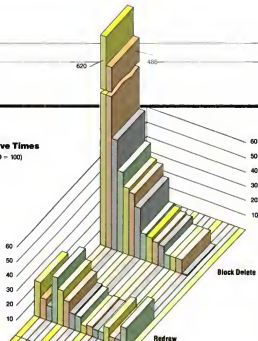
* File was saved using "single precision"; "double precision" results are in 31K-byte file.

† Unlike the other packages tested, *ECAD Drafting Software* does not automatically redraw when zooming. A separate redraw command was executed, and the times of the zoom and redraw commands were then added together.

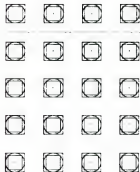
‡ N/A—Not applicable: *Drafix 3D Modeler* could not do a group delete.

§ N/A—Not applicable: *Pro3D/PC* could not create 3-D test images.

Relative Times
(AutoCAD = 100)



A portion of the drawing used for our tests is reproduced below. It consists of a ten-by-ten array of entities. Each entity consists of a square that contains an inscribed circle with another square inscribed in it. Two dotted diagonal lines are drawn from the corners of the outer square. Each entity is separated from the others on all sides by 1/4 inch.



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LOGITECH'S COMPLETE CADD SOLUTION \$189
For beginner to advanced, it's a complete solution for dimensioned line drawing and CADD. Package includes Mouse, Plus Software, and LOGICADD.

■ LOW-COST CADD

project, for each individual drawing, and for symbol libraries. *ECAD* puts them in the root directory of your drive. But you can't change the directories from within the program, nor does the manual tell you how to change them.

You'll need to find out a great many other aspects of the program through experimentation. For instance, the manual doesn't mention that you can't trim circles, ellipses, arcs, and fillets; nor does it indicate that to erase a circle, an arc, or an ellipse, you must include the center and more than half the entity within the selection window.

Another detail the manual neglects to inform you about is that *ds* at the cursor position readout is the square root of the sum of *dx* squared and *dy* squared. When you're using the Multiple-Line command, the offset equals *ds* rather than *dx* or *dy*.

Also, you find out through experience that you can't make a fillet between an arc and a line or with another arc. And when you're using the Curve command to put a continuous curve through a series of points, you must enter the fifth point before *ECAD* will start to draw the curve—what's more, it starts at the second point, not the first. If you don't know what's going on, you may give up before you get to the fifth point because you think nothing is happening.

In addition, you'll find that *ECAD* can't draw a circle that has its center off the drawing. And when you set up the program and are asked to select continuous or noncontinuous lines, you'll want to choose noncontinuous when drawing contour lines on a map—to avoid having *ECAD* fill in the corners of a string of line segments. Still another detail that the 47-page manual doesn't tell you is that when you tap the left mouse button between commands, the menus at the bottom of the screen switch places; this is handy but startling until you figure out what's happening.

STRONG AND FAST *ECAD*'s surprises are annoying but not crippling. The package has some strong features. Thanks to tight coding, it occupies only one disk, and it really flies. The snap function has seven modes, lacking only Snap-tangent-to-arc. Zoom and pan are fast. And you can easily set and reset the zoom ratios.

The cursor readout is handy, with the *x/y* position always present. Once you've anchored a point, *ds* the straight-line distance from the anchored point to the cursor and the angle that the line makes to the origin also appear. And you can choose to have that status relative to the origin or the anchored point. The *x/y/dx/dy/ds* readout and the ability to change cursor step size make it easy to draw an object to exact scale, subsequently auto-dimension it, and measure any entity.

■ *ECAD* has some strong features. Thanks to remarkably tight coding, it occupies only one disk, and it really flies.

You can select cartesian, polar, north azimuth, south azimuth, and bearing coordinate systems at any time. You can also rotate the origin at any time, with only subsequent operations affected.

ECAD lets you choose to input from the cursor position or the numeric keyboard, and your inputs may be absolute (from origin) or relative to the last point. The program has no library of standard items; you create your own. But making and retrieving up to 140 library items, which can even be complete drawings, is easy. Caution: when you identify an item to save in the library, make sure that the basepoint of the item is easily identifiable as well as its orientation to the origin; otherwise you might end up with a gear that looks like a rip saw, as ours did on the first pass.

The function keys in combination with Shift, Alt, and Ctrl invoke most of the commands. The next version of *ECAD* will allow mouse picks.

ECAD's editing commands are powerful and easy to use, once you sort out their interactions and capabilities. When you set the remove flag, for example, Snap-to-entity becomes Snap-to-and-erase-entity, and Copy copies and removes the original.

ECAD lists no move command, but

Change (position) does the job nicely. Change also lets you stretch an entity. The Copy command works well to rotate, mirror (*x* or *y*), resize, or remove entities. The Restore command lets you retrieve keystrokes, and Delete Last will delete the last entity and allow you to retrieve it. Actually, you can delete as far back as you like, removing each entity in reverse order to its creation. You can then restore the entities in reverse order to their deletion.

Fill is nonexistent, and the Hatch command might as well be. To create hatching, you can draw a series of lines with the multiple line and copy commands, saving them as a symbol with the basepoint at the center. But you have to bring the symbol in within a window and trim it to fit your drawing. Had this method worked for us, the multiple lines would have created hatching. But even after a call to Pelton, we still couldn't make it work.

LAYERING *ECAD* permits you to use up to 140 layers in a drawing. Actually, you could use more, but the built-in index will index only 140 (the same limitation applies to library items). Turning layers on and off and putting any particular one on top, where you can manipulate it, are both pretty straightforward. A handy indicator on the status line tells how nearly full the top layer is. Each layer can hold 45,056 bytes—about 1,000 separate lines, arcs, or circles in double precision, or about 1,600 in single precision.

The program can export DXF files but not IGES. When we tried to import a DXF or IGES, the system locked up and we had no choice but to reboot.

A final complaint: if you've done something wrong, the system lets you proceed through a sequence of actions until, when you issue the last keystroke, it dumps you back to the start, with no indication of what went wrong. An error message at the point where you first make the mistake would make using *ECAD* much less exasperating.

ECAD is a fast and versatile package with plenty of power, but few frills. Its potential is strong, but the inadequate manual does a poor job of communicating what the package can do and how to make it work. Trial and error is *ECAD*'s middle name.

—Carlos Pinkstaff

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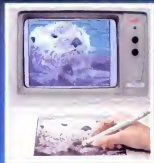
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PC 12/87

EntekCAD

EntekCAD, from Entek Scientific Corp., is a basic package that costs \$195 and has a very awkward user interface.

The package is divided into eight separate tasks: drawing, dimensioning, hatching, sectioning, manipulating the drawing database, and three plot utilities. You must select these tasks one at a time from a menu.

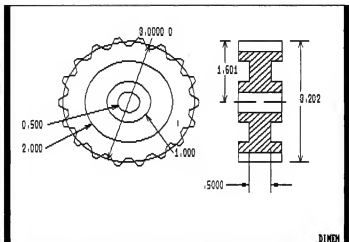
To switch from one task to another, you must write the drawing to disk, switch to the new task, and read the drawing back in again. Each time you do that, you type the filename twice—once to write it out and once to read it back. While the package lets you display the file directory, the list disappears before you can type in the name of the file that you want.

EntekCAD supplies the usual facilities to draw arcs, lines, points, and circles. But you need to learn six different command sets to use them. You select four command sets by entering function keys; two command sets are selected by typing either a slash ("/") or a dot (".") followed by a single-letter command name—for example, /M—to move the drawing around on the screen or .P to display the coordinates of the point nearest the cursor.

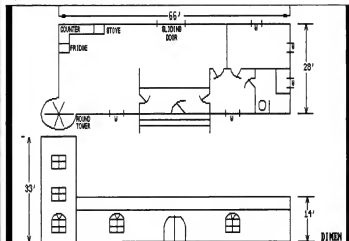
You select the function-key command sets by entering NUMBERS!! Typing the numeral 1 means "Move to coordinate (x, y)," "Move to cursor location," "Draw parallel construction line," or "Horizontal dimension," depending on which command set you are in.

One positive aspect of the interface is that each command prompts you for the points it needs and tells you what each point is for as you enter it. For example, the Arc command prompts for a center point, a radius, a starting angle, and an ending angle in that order. Once you learn the definition of each number, you do not have to remember the right order to enter the points for each command.

DRAWING EntekCAD lets you define entities by moving the cursor; by snapping the cursor to the nearest point, to the nearest intersection of construction lines, or to the nearest grid point; or by entering its absolute or polar coordinates. The package offers four cursor step sizes that you select



To use EntekCAD to draw a gear tooth, I created construction lines starting from the center of the gear that helped me define arcs of 1.6 inches, running from -5 to $+5$ degrees for the first tooth, from 15 to 25 degrees for the second tooth, and so on. After drawing several teeth, I was able to Copy and Rotate them to create the remaining teeth.



Drawing the floor plan with EntekCAD was more difficult than it should have been because of the need to switch tasks for the various functions. Drawing and dimensioning, for instance, are separate tasks requiring that you exit from one and reenter the other. This process is made more difficult because the package offers six different command sets.

by entering four function keys.

You can specify an arc in terms of center point, radius, and starting and ending angles.

The hatching program is a separate

task: write the drawing to a disk file, select an entity containing exactly one closed curve to hatch, write that entity to a separate temporary file, switch to the hatch task, read in the temporary file to be

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■ LOW-COST CADD



FACT FILE



EtekCAD, Version 1.3
EtekCAD Scientific Corp.
4480 Lake Forest Dr.,
#316
Cincinnati, OH 45242
(513) 563-7500
List Price: \$195

Requires: 256K RAM, two disk drives or hard disk, DOS 2.0 or later, 8087/80287 co-processor or recommended.

Supports: IBM CGA, EGA, or compatibles; Mouse Systems PC Mouse or compatibles. Dot matrix printers; plotters.

In Short: An adequate two-dimensional drawing program that is inconvenient to use. Not copy protected.

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hatched, hatch it, write it out again, switch back to the drawing task, read the drawing back in, read in the hatched entity, and position it in the right place in the drawing. The word *awkward* was coined to describe such procedures. The hatcher lets you select the line angle and line spacing.

DIMENSIONING Like the hatcher, the dimensioner is a completely separate task—you must write the file, change tasks, and read the drawing in order to dimension it. To dimension a line, you must either dimension from endpoints of a line, or specify a dimension point. Since you can't add dimension points when you're in the dimension task, if you wish to add a dimension point then, you have to go back to the drawing task, put in the desired point, cycle back to the dimension task, and pick up where you left off.

While you can manually override the dimensioner to change the units printed on the drawing, you not only have to reenter the text manually but also reenter the arrows. The dimensioner does offer a limited form of associative dimensioning: it will recalculate dimensions for you if you re-scale the drawing, but only for those points it has computed itself. It ignores any numbers you entered manually.

TEST DRAWING For the test gear drawing, I was able to start at the center of the gear and define arcs with a radius of 1.6

inches running from minus 5 degrees to plus 5 degrees for the first tooth, 15 to 25 degrees for the second, and so on. When I drew the gear, I drew the first 5 teeth, copied and rotated those 5 teeth to get 10, then copied and rotated 8 of those 10 teeth to get the 18 teeth in the gear.

In drawing the gear I took pains to avoid switching tasks more than necessary, but still ended up doing it frequently. I had to switch from drawing to dimensioning, back to drawing, and then to copy a section of the gear to a different file because the hatcher insists on hatching complete files. Next I went back to the drawing routine to put the hatched part back in the drawing, then back to the dimensioner, and on and on.

When you select an entity for performing some sort of operation, you can't choose all entities in a particular portion of the display. Instead you can pick only the objects that consist of contiguous line segments. Fortunately I was expecting this problem and was careful to draw my teeth so that I could select them.

Drawing the house was straightforward, if tedious. I first figured out the *x* and *y* coordinates of every point in each wall, door, and window in the drawing, then drew lines between the points by typing in the *x* and *y* coordinates. Door arcs were easy because I had already located the endpoints of the doors. The command to enter arcs in terms of center, radius, and angles made entering door swings simple.

EtekCAD is less than adequate as a CAD system. You can make drawings and hatch and dimension them, but it has a hostile interface because of its complex command structure and the need to have you write drawings out and read them back in again for hatching and dimensioning. —William Taylor

Generic CADD

Generic CADD, Version 3.0, from Generic Software, is unusual for its marketing strategy. An initial \$99.95 gets you the bare-bones package, which includes enough features to teach you CADD. Many that would normally be considered part of a CADD package are available as options. This approach lets you mix and match, choosing only the portions you will

need for your application. Even if you purchased every optional module, you'd wind up with a full-featured *AutoCAD* rival—for just over \$500. And, it includes a 60-day money-back guarantee.

The Drafting Enhancements-1 (DE-1) module, for instance, gives you snap features; Drafting Enhancements-2 (DE-2) offers hatching; and Auto Dimensioning handles dimensions. Optional symbol libraries (home design, electronics, and others) are also available; they are well organized and nicely documented. And considering the price—\$49.95 per package—no user who needs any of these modules can afford to do without them.

Generic Software has repackaged an earlier version of this product and called it *FirstCADD*, listing it for \$49.95. While it is an excellent introductory product that



EDITOR'S CHOICE FACT FILE

CADD 3.0

Generic CADD, Version 3.0
Generic Software Inc.
8763 148th Ave. NE
Redmond, WA 98052
(800) 228-3601
List Price: \$99.95; Auto Dimensioning, \$49.95;

Drafting Enhancements-1, \$49.95; Drafting Enhancements-2, \$49.95; Auto Convert, \$49.95; Generic IGES, \$249.95.

Requires: 384K RAM, two disk drives, DOS 2.0 or later.

Supports: AT&T 6300 monochrome; Everest Edge; Hercules monochrome graphics adapter or compatible; IBM CGA, EGA, or compatibles; Microsoft Mouse or compatibles; Persyut BOB; Photon Mega board; Quadram QEGA Pro-Synch; Tseng EVA 480; Video 7 Vega and Vega Deluxe; Wyse WY-700, Calcomp 2000, 2100, and 2500; GTCO Digi-Pad Type 5A; Houston Instrument HiPAD and Truerr; Hitachi 1111B and 1111C; Kurta Series One, Two, and Pen-Mouse; Mitsubishi Grafix; Numonics 2200 series; SAC GP-7 and GP-8; Summagraphics 1200, 1201, 1812, and MicroGrid. Dot matrix and laser printers; plotters.

In Short: A powerful production drafting program at an amazingly low price. It offers a good number of features, quality documentation, and optional low-cost modules to customize the program to your application. Not copy protected.

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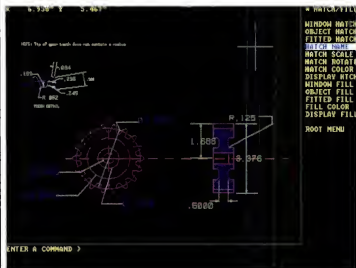


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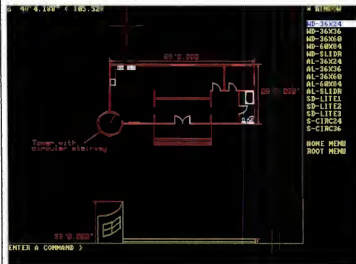
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■ LOW-COST CADD



Because Generic CADD lacks a circular array feature, constructing the gear was more difficult than necessary. After the tooth was constructed by drawing in its coordinates, the Window Mirror command was used to copy the tooth over the axis. The Window Rotate and Window Move commands placed the pairs of teeth around the circle.



Generic CADD's double-line, orthogonal snap, and intersection cleanup features make this package particularly useful for architectural applications. We used them all to create the test drawing. An optional symbol library called "Basic Home Design" contributed a stove, a refrigerator, doors, and windows to the floor plan.

costs no more than many games, anyone seriously interested in CADD should just buy *Generic CADD 3.0*.

GENERIC USE *Generic CADD's* drawing screen resembles that of *AutoCAD*. A list of command lines runs along the right side of the display. A command entry area is located at the lower left of the screen; at the upper left, an indicator shows the current location of the cursor—in user-selectable units.

With just a few keystrokes, you can change the colors of all the screen displays and even make the video menu disappear entirely, thus freeing the entire screen area for graphics use.

The commands that appear on the video menu are complete words: *draw*, *component*, *line*, and so on. You can invoke commands using their two-letter abbreviations, though the abbreviations are not entirely intuitive: *trim*, for example, is "RM," and *extend* is "XT." Since the menu is simply an ASCII file, the serious user could easily change it to incorporate more memorable abbreviations. There is also an easy way to "back out" of almost any operation in progress. While *Generic CADD* offers an unerase feature, it should also offer an undo command—even if that command would go back only one operation.

Like *AutoCAD*, *Generic CADD* organizes its menus hierarchically into a "root" menu and associated submenus. A highlighting cursor moves vertically along the menu bar, while the graphics cursor moves everywhere on the screen. You select commands by pressing the middle button of a three-button mouse or the right-hand button of a two-button mouse; you enter points with the left-hand button.

You can program extra buttons on your pointing device (whether it be a mouse, digitizer, or some other device), or you can program function keys to initiate any command or sequence of commands. Pressing the Spacebar repeats the last command (something I learned from the technical support people, not from the manual). While these macro capabilities are useful, a real programming language like *AutoLISP*, with conditional branching, prompting, named variables, and looping would make *Generic CADD* a true competitor to *AutoCAD*.

■ LOW-COST CADD

The system automatically comes up in line-drawing mode. You can enter lines simply by placing points, and a stretching line appears as a visualization aid. Each line segment you create has its own distinct endpoints, even if it appears to share an endpoint with another line.

Layer and component management is excellent, as are snaps and grids. Geometry creation and peripheral support are also very good. Generic software should, however, offer parenthetical commands that would allow you to place a point, zoom to some other location on the screen, and then place the second point. Such a feature would be useful for performing operations on large documents. But you can use some of the snap commands this way, which is very helpful. The package also lacks array commands. Instead, you must use the Window Copy command to construct a row of objects, which you can then copy and rotate to make an array.

Generic CADD's text management capabilities are adequate. It offers multiple and user-definable fonts. You can replace portions of an existing text block without having to retype the entire block. In fact, the program stores each character as an individual entity that can be moved and otherwise manipulated as such. But while the package offers many other subtle text-handling capabilities, it does not allow you to justify text, align it automatically to match a given space, or run it along an arc or curve.

For symbol libraries, the package lets you access a DOS-style directory without leaving the program, but you must return to the graphical portion of the program and enter the name of the symbol library in order to load it. Nor can you simply point at a filename to load it, as you can with the menus for the symbol libraries. This is a disadvantage because you need to remember filenames to retrieve them from within the program. Finally, the program ought to have nongraphical attributes that would enable it to generate a bill of materials for creating lists of parts.

Generic CADD's responsiveness on an AT with a math coprocessor is adequate. The program's 18.3-second redraw time and 8.75-second deletion time on the PC Labs performance tests put it among the fastest half of the pack tested here.

TEST DRAWINGS To create the gear, I first designed the tooth by constructing the straight lines with the package's relative coordinate and snap features, using its Arc and Fillet commands for the round parts. I next used the Window Mirror command to copy the tooth across the center of the gear. After making eight copies of the pair of teeth, I used Window Rotate and Window Move commands to place them around the gear circle. While closer analysis might

■ *Generic CADD's*
layer and component
management is excellent;
geometry creation
and peripheral support
are also very good.

have made shorter work of this gear, a circular array command would be necessary to make the gear construction quick and easy.

I used my original tooth construction to make the detail drawing. I then drew construction lines from the main gear to create the side view. To hatch the solid areas of the gear in the side view, the Fitted Hatch command was necessary. This command lets you indicate the drawing entities that bound the area to be hatched; it finds the intersections and hatches the area. (Hatching is in the optional DE-2 package, not in basic *Generic CADD* 3.0.)

The optional Auto Dimensioning package made dimensioning simple. It contains five different line terminators, along with definable witness line length and offset, text height and placement, and more. Unfortunately, it does not allow for user-definable line terminators.

Increasing various dimensions of the gear was easy with the Scale Window command. Together with the keyboard coordinate input, this feature allowed me to make the changes in just a few minutes. I was able to use the Stretch Straight Lines option in the Window Move command to

good advantage in creating the section of the enlarged gear.

For the architectural test drawing, I used the double-line, orthogonal snap, and intersection cleanup features. An optional symbol library called "Basic Home Design" contributed a stove, a refrigerator, doors, and windows in both elevation and plan view. To find these components, you simply look them up on a menu and select them for placement.

IGES TRANSLATION IGES conversion comes as part of an optional \$249.95 module. Its documentation is not quite as friendly as that of the other modules and is full of typographical, grammatical, and spelling errors. The module's alphanumeric menu will be meaningless to anyone not familiar with IGES.

The AutoCAD nozzle translated fairly well, though a number of arcs mistranslated. In translating the test gear drawing into and out of IGES, some lines were lost and some hatching was inexplicably duplicated. (These problems are common to "untuned" IGES translations; they are not unique to the Generic product.)

INSTALLATION AND DOCUMENTATION *Generic CADD's* documentation is nicely laid out and well written, with frequent tips and cautionary remarks. Generic Software's warranty lets you return the product for a full refund within 60 days if you don't like it and haven't damaged the packaging. The company will replace defective disks for up to 90 days. Although the company's non-toll-free hot line was often busy, the technical support people demonstrated a real knowledge of and enthusiasm for the product.

The installation process took less than 5 minutes. Configuring the program for my display, pointing device, and output device was simply a matter of picking the devices' names off lists.

COMPARED WITH AUTOCAD AutoCAD has a richer command structure than *Generic CADD*—there are more ways to do anything you want to do—but it is consequently harder to learn. While many third-party programs work with AutoCAD, few work with *Generic CADD*. And AutoCAD has a real programming language.

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■ LOW-COST CADD

On the other hand, *Generic CADD* feels more responsive and is easier to learn. For less than \$350, you can configure *Generic CADD* to have about 70 percent of the drafting power that *AutoCAD* offers.

IN SUM The double-line capabilities of *Generic CADD*, Version 3.0, and DE-1, coupled with the available symbol libraries, make the package particularly attractive for architects, despite the lack of the standard architect's tick-mark dimension line terminators. For mechanical engineers, the lack of array commands and tolerance capabilities is a minor drawback. And for electronics engineers, the only missing feature is the ability to enter and extract nongraphical attributes.

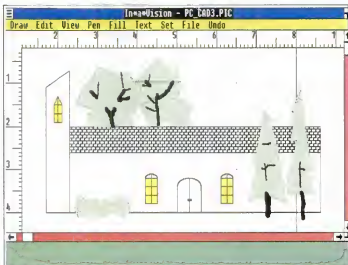
Overall, *Generic CADD*, Version 3.0, more than lives up to its advertising claims. It is a slickly packaged, smoothly operating production drafting system. I had to work hard to find any features missing from it. This product is an outstanding value from every point of view and is highly recommended.—Joel N. Orr

In*a*Vision

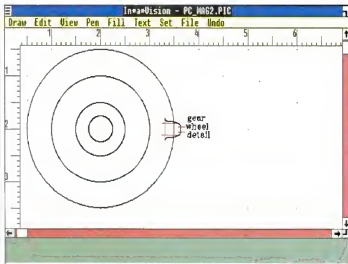
*In*a*Vision*, which costs \$495, was designed to work in the *Microsoft Windows* operating environment, although its appearance actually predated that of *Windows* by a few months. It will operate either in *Windows* or as a standalone using an included *Windows* run-time module. With the user interfaces one would expect from a *Windows* application—pull-down menus, dialog boxes, and icons to symbolize files and functions—*In*a*Vision* is user friendly indeed for those familiar with *Windows*. Those who aren't might want a crash course in double-clicking, window moving, icon building, and other *Windows* techniques.

FEATURES AND PROCEDURES *In*a*Vision's* method of maintaining drawing information differs from that of other CADD packages. Most CADD software creates a mathematical model of each entity. The theoretical resolution of such a drawing is infinitely small, limited only by the mathematical precision of the CPU.

*In*a*Vision*, on the other hand, uses a



*In*a*Vision* excels at freehand drawings, such as this front view of the house plan. It offers eight colors and numerous fill and crosshatching features. To help you draw straight and parallel lines, you can snap to the adjustable subdivisions on the ruler that surrounds the drawing screen. Also note *In*a*Vision's* *Windows* interface.



Mechanical drawing is not *In*a*Vision's* forte. Its resolution is limited to .002 inch, and it has limited snap features. We calculated every coordinate for the gear tooth shown, which took hours. And since the program only rotates objects 90 degrees, we could not copy the tooth around the circle—we would have had to calculate every point by hand.



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technique that includes function calls to *Windows* to generate pictures. This technique limits the accuracy of *In*a*Vision* drawings to a minimum of .002 inches. While this limitation may not be serious in some applications, it may be a severe one for detailed technical drafting.

*In*a*Vision's* drawing technique is best suited to free-form drawing. Unlike most CADD packages, which convert a free-form curve into many tiny line segments that end up looking ragged, *In*a*Vision* draws the curves exactly where you move your mouse. Consequently, this software would be an outstanding choice for graphical illustration where a fair amount of freehand drawing is required.

And, in fact, *In*a*Vision* does seem geared toward free-form drawing applications. The contents of the sample ClipArt library included are telling. There we found pictures of dogs and elephants, space ships and old cars, and other attractive items that could easily spice up a newsletter. We found no dimensioned drawings of machine parts, although there was one undimensioned floor plan of an office.

But when it comes to features commonly found in CADD packages, *In*a*Vision* falls short. It does not allow you to define one entity in terms of another. Therefore, you cannot snap one line to the endpoint of another, nor can you snap the cursor to the intersection of two entities, nor trim two entities so that they meet in a perfect intersection.

The package also offers no way to delete part of a line if you accidentally draw it too long. *In*a*Vision* allows you to correct this problem by selecting the entity for modification and adjusting the size of the boundary box around the entity. You then shrink the line to fit. But you have to do this without snap assistance; you must place the cursor exactly where you need it—a task that takes a steady hand and a fair amount of patience.

*In*a*Vision* does support one kind of snap: a "ruler snap." The *In*a*Vision* screen is bordered by rulers, which contain a number of subdivisions that are somewhat adjustable; you can force the cursor to snap to one of those ruler subdivisions.

*In*a*Vision* has a horizontal/vertical line draw function that helps you keep your



FACT FILE



In*a*Vision
Micrograph's Inc.
1820 N. Greenville
Richardson, TX 75081
(214) 234-1769
List Price: \$495; *Windows* Convert, \$99; *CAD ClipArt*, \$99.95; *Windows ClipArt*, \$99.95

Requires: 320K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.

Supports: All hardware supported by *Microsoft Windows*.

In Short: An easy-to-use package that runs under *Microsoft Windows*. It's great for graphics artwork and semitechnical drawing, but it doesn't offer adequate resolution or features for mechanical drafting and design (it lacks a radial array, for instance). Not copy protected.

CIRCLE 646 ON READER SERVICE CARD

lines parallel and perpendicular. Creating a rectangle with the exact 66-feet by 28-feet scale for the test architectural drawing was a challenge. You need to use the Show Dimensions and Crosshairs command to draw lengths and to position lines properly. Even if you'd rather work in feet and inches, you'll have to use feet and decimal feet. Instead of trying to draw double-lined walls, we used the thick-line-width feature.

LEARNING TO DRAW After attempting to draw a dimensionally accurate rendering, we decided to use *In*a*Vision* in the way it works best—as a freehand drawing tool. Using the ruler snap mode and the grid points on the drawing page, we were confident that our drawing was reasonably accurate. Using *In*a*Vision* this way turned a frustrating experience into a more pleasant one, and *In*a*Vision's* good points began to show.

We found that drawing is intuitive; pulling down the menus to choose drawing entities and whizzing the mouse around the drawing area, we soon created a passable house plan. Each entity has an invisible boundary box that surrounds all the pixels in the entity. You can make this boundary box visible and move, shrink, expand, or otherwise manipulate the entity in an intu-

itive way by dragging it with the mouse.

*In*a*Vision* offers no automatic dimensioning capabilities. This does not mean that you can't add dimensions to a drawing—just that you have to construct them manually from text and lines. The program does tell you dimensions, but you must key in the values manually. And you have no guarantee that they will be accurate—we facetiously labeled a 5-foot wall as being 8 feet long just to prove that it can be done.

The package offers a variety of fonts and text heights for labels. Using boundary boxes around the text, you can stretch or shrink a label to any size you wish.

One drawback of the *Windows* environment is that the program leaves an empty space in the drawing after a dialog box pops up and is used. You must redraw this area. Luckily, this package had the fastest redraw times of all the products that underwent the PC Labs performance tests.

On the other hand, the *Windows* environment allows very convenient cut-and-paste operations within a drawing and between drawings in different windows. You can literally litter your screen with windows, scrunched together or overlapping.

To have fun, we drew the front of the house with its curious turret and threw in a few extras like trees, shrubs, and shingles. *In*a*Vision* is perfect for this kind of work. It supports eight colors and has extensive fill and cross hatching facilities, although you cannot design your own cross-hatch patterns.

The gear wheel drawing was another matter. Because of the limitations on resolution and the lack of useful snap modes, constructing even one tooth of the gear took several hours. We had to resort to using *In*a*Vision's* coordinates. You can display the coordinates of the cursor, specified in terms of a rather arbitrary 460 units per inch. By using a calculator and some high-school geometry, we calculated the coordinates of the necessary construction lines, then built the gear tooth. Then we felt really stumped. Since *In*a*Vision* can rotate an object only by 90 degrees, we couldn't copy the first gear tooth with a 20-degree rotation. The only way to construct the rest of the gear would be to perform a huge number of trigonometry calculations to come up with the absolute coordinates

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of each necessary point for each gear tooth. The task was too much for us. When we called the Micrografix support staff and asked how they would do the drawing, they told us that their art department would, for a fee, develop any artwork we wished, including the gear. They admitted, though, that this kind of drawing is not *In*o*Vision's* forte.

EXPORTING AND OUTPUTTING FILES

Micrografix sells an add-on package for *In*o*Vision* called *Windows Convert*. Its function is to export *In*o*Vision* drawings into the DXF-format files that *AutoCAD* uses. *Windows Convert* is an application that you can load into *Microsoft Windows* when you need it. Although the conversion process takes some time, it is simple to operate. We were able to export our house plan to *AutoCAD* with no problems. However, when we tried to export our drawing of the front of the house, complete with crosshatched shrubbery and free-form tree branches, *AutoCAD* gave us a message that the DXF file we had produced had some flaws and could not be loaded. Hence we concluded that straightforward drawings of simple element types can be exported to *AutoCAD*, but drawings with lots of crosshatching and free-form lines may create problems.

In the manual, the *In*o*Vision* technique for printing dot matrix output looks flexible and straightforward. You can print a selected number of pages of your drawing (conceivably allowing you to make a huge drawing by taping the individual 8 1/2- by 11-inch sheets together) or draw a box around the portion of the drawing you want to print. In practice, however, getting a hard copy of our drawing proved to be a tedious exercise in arcane commands. Helpful dialog boxes popped up to assist us, and icons representing the print spooler appeared in the icon strip at the bottom of the screen. Yet our printer remained immobile. We had to resort to using a text editor to do surgery on a parameter file (the manual tells you how) to eliminate the spooler. After a few more tries at the dialog boxes, we got our printout. In the end we were bewildered—why is getting a printout such a complicated affair? In fairness, this is a problem with *Windows* as much as with *In*o*Vision*.

GETTING STARTED Although the *In*o*Vision* documentation is well organized, it contains no illustrations, has only a skimpy index, and fails to explain some of the more subtle technical points.

The installation procedure packs no surprises; just follow the directions. Once the screen comes up, it is immediately apparent how to use the fundamental functions of the software: you pull down a likely menu and make a choice. We were doodling and sketching in no time.

We liked *In*o*Vision*—it's user-friendly and even fun, with enough technically oriented features to make it useful for more applications than most "paint" software. We think *In*o*Vision* has been the victim of mismarketing: it is much more appropriate for graphic design and drawing than for technical drafting where high accuracy is required. It would also be fine for use by a homeowner who wanted to sketch out a floor plan. In fact, it is one of the best packages we have seen for this market. But when it comes to competing with *AutoCAD* in the technical drafting arena, sorry, it doesn't do the job.

Micrografix is due to release a more powerful sibling, called *Windows CAD*, shortly. We saw a prerelease version, and it was more robust than *In*o*Vision*. —Donald C. Peckham and Martin L. Ramsy

LaserCAD

LaserCAD, a PC-based CADD package from DSL of Midvale, Utah, is a 2-D drafting system that offers an impressive complement of features usually found only in programs costing much more. Serious users will find it a capable tool. The few features it does lack, coupled with documentation that is barely adequate and minor shortcomings in the user interface, are all that keep it from being an outstanding value for the \$99.95 retail price.

INSTALLATION *LaserCAD's* installation procedure is outlined in an appendix at the rear of the manual, out of the way of the reference material but easy to find. Other manufacturers might take a lesson from this installation process. Hard disk setup simply requires you to create two special directories—one for the program



FACT FILE



**LaserCAD,
Version 4.01**
DSL Inc.
2450 E. 7000 South
Salt Lake City, UT
84121
(801) 566-9238
List Price: \$99.95

Requires: 512K RAM (640K RAM recommended); two disk drives (hard disk recommended); DOS 2.0 or later; 8087/80287 co-processor recommended.

Supports: Hercules monochrome graphics adapter or compatibles; IBM CGA, EGA, VGA, and compatibles; Infograph 100; Microsoft Mouse or compatibles; GTCO DPad 7 and Digipad 5, Houston Instrument Hi-Pad and Tru-Grid, Kurta Series One and Two, Summagraphics Summa Sketch, or any tablet supporting the bit pad 1 format. Dot matrix and laser printers; plotters.

In Short: A menu-driven CADD program that packs a multitude of features typically found in much more expensive packages. However, its user interface and lack of a point command hamper fast and efficient use. The manual is for reference only and offers no tutorial; expect to place a few calls to Technical Support during the learning phase. Not copy protected.

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files and one for drawings—then copy everything over from the four supplied diskettes, add the program directory to your PATH, and add BUFFERS=20 and FILES=20 to your CONFIG.SYS file if they don't already exist. There's no automatic configuration file to trash your AUTOEXEC file and litter your hard disk with a maze of unwanted directories, nor is there any assumption on DSL's part that the average user is too unsophisticated to follow simple instructions.

The first time you run the program, an *AutoCAD*-like configuration utility lets you specify your equipment via menu selections. *LaserCAD* supports a wide variety of popular graphics displays, digitizers, mice, plotters, and printers through custom drivers supplied as overlay files. The one notable exception is Microsoft's bus mouse, which, inexplicably, isn't recognized although the Microsoft serial mouse is. Nor did Version 4.01 of the program, current at the time of this writing,



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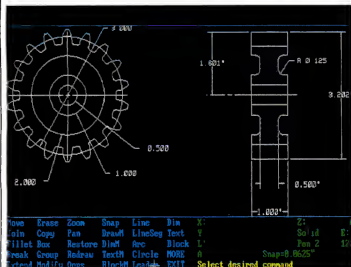
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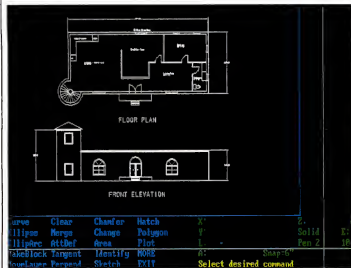
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The gear was constructed by creating a construction line whose endpoints served as the center point and the top of the tooth. Circles were drawn around the center point, and generated half of a tooth as an adjoining line segment and arc. The first half was then mirrored and the radial array used to fill in the remaining teeth.



To create the architectural drawing with LaserCAD, a grid to rough in outlines was set up, then zoomed to create a finer grid for details (the grids are erased here). The Copy command made double-line walls a breeze. The Join command automatically extends two nonintersecting perpendicular lines to form a smooth right angle.

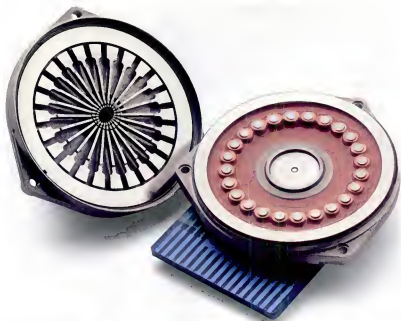
contain drivers for IBM's newly introduced PS/2 mouse.

DRAWING CONCEPTS The concept of subdividing a drawing package into pages, layers, and blocks or symbols is fully supported and administered through a two-tiered menu infrastructure. The highest level, labeled the root menu, contains commands to manipulate paper sizes, scales, pages, layers, and blocks. Convert provides the capability to read and write DXF files. The DOS command shells out to COMMAND.COM and allows you to perform file operations without leaving LaserCAD.

Choosing the DrawLayer command from the root menu drops you down a level to the DrawLayer menu, which provides a rich array of features that facilitate drawing and design. A wide variety of pen types, line types, and object types are supported. Designers experienced with mainframe CADD systems and users of AutoCAD will recognize many commands such as Snap, Area, Fillet, Change, Chamfer, and Hatch. Conspicuously missing is a Point command. LaserCAD, in an attempt to introduce a breath of fresh air to the concept of computer-aided drafting, doesn't provide an explicit way to create point entities. Users accustomed to beginning a drawing by laying out a few critical points defining the centers and extremes of objects will find themselves forced to embrace a new way of thinking.

I found the lack of a Point command annoying. To create a point in space to serve as a center for both a circle and a radial array of objects, for example, I had to draw a line segment and use one of its endpoints as a center point, then erase the construction line. Surprisingly, LaserCAD wouldn't let me use the intersection of two lines as a control point.

You select commands by using the mouse or digitizer. The package does not allow you to enter selections from the keyboard. LaserCAD carries this reliance on the pointing device to an extreme when it forces you to make numeric entries by picking each digit from a menu—a process not unlike typing by using your mouse to press the buttons of an on-screen keyboard. It's slow and tedious. DSL would be well advised to add the option of key-



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board entry for numbers representing coordinates, distances, and other parameters.

LaserCAD made the process of creating the drawings required for this review relatively easy—except that learning the package required a few calls to Technical Support and some trial and error. When the system refused to accept my command to copy a three-point arc representing one side of a gear tooth, for instance, the reason turned out to be that the box drawn to capture it had to include not just the visible portion of the arc, but also its unseen center point. Technical support was fast, friendly, and efficient.

The single manual packed with *LaserCAD* is a reference volume; it has only a halfhearted index and sorely needs some sort of tutorial. Learning how to use the package through the manual is like learning how to speak English through a dictionary. Help is on the way, however: DSL sent me a final draft of its upcoming *LaserCAD* tutorial, a step-by-step guide to creating a set of sample drawings that may be available by the time you read this.

GEAR DRAWING In drawing the front view of a gear, I first created a construction line whose endpoints served as a center point and as the extreme of the topmost tooth. I drew circles around the center point with Circle and generated half of a tooth as an adjoining line segment and arc. I completed the tooth by mirroring the first half, and *LaserCAD*'s ability to create a radial array of objects made short work of filling in the remaining teeth. Adjacent teeth were joined by an arc created using the Center-Start-End option, with the endpoints of the teeth serving as the starting and ending points. Finally, I "radiused" the corners with the Fillet option.

LaserCAD offers many ways to create entities through robust submenus. Pick Arc, for example, and fully seven construction options are listed ranging from Three-Point to Center-Start-Chord.

I constructed the side view of the gear as a union of line segments. Cross-hatching was fast and functional. *LaserCAD* offers a tremendous variety of hatching patterns, arrowheads, and architectural symbols in the form of blocks stored on disk. The only catch is that until you load the patterns with CopyBlock from the root

menu, your efforts to crosshatch and dimension objects will be met with error messages. And before you invoke CopyBlock, you must know the name of the file you're looking for and where it's located. Likewise, you must load a font with LoadFont before you can place any text. The manual never spells this out. DSL suggested that to keep from having to repeat this setup process at the start of every drawing, you could create a standard drawing template to serve as the starting point.

■ *LaserCAD*'s Zoom is fast and intuitive; zooms are nested and can be successively undone using the Restore command.

Dimensioning works just as it should. *LaserCAD* asks you to pick an object to dimension or two objects to dimension between, then specify where the text of the dimension should be placed. It then pulls the proper mathematical values from its own internal database and produces the dimension. *LaserCAD* will automatically add tolerances if you so specify, will stack or chain dimensions, and more. In short, nearly every dimensioning option you can think of is present and supported.

LaserCAD is a 2-D system only and contains no support for three-dimensional modeling. It does, however, offer a 30-degree line-snapping mode to aid in the creation of isometrics.

Architectural drawings come quite easily by setting up a coarse grid to rough in outlines, then zooming in on selected areas and establishing a finer grid to fill in the details. Zoom is fast and intuitive; zooms are nested and can be successively undone using the Restore command. The Copy command makes double-line walls a breeze. Join will automatically extend two nonintersecting perpendicular lines to form a smooth right angle. If the symbols library packaged with *LaserCAD* doesn't have what you want in the line of arrowheads,

door swings, water closets, and so on, it's easy enough to create your own with the DrawBlock command from the root menu.

LaserCAD does a thorough job of reading and writing neutral-format DXF files. It imported the classic *AutoCAD* firehose nozzle drawing without so much as a whimper, and successfully read back a DXF file it created itself. *LaserCAD* does not support the IGES standard.

If *LaserCAD* does have significant drawbacks, they lie in the implementation and not in the concepts. One bothersome feature is that when you're asked to pick a point, you can't decide on the fly between entering its offset from the previous point or selecting an existing point with the digitizer. You must choose a selection mode beforehand, and changing your mind requires clicking through no less than three menu selections. And since the DrawLayer menu lacks a save feature, saving a drawing requires you to exit to the root menu, use its Save command, and pop back to DrawLayer. A feature to trim a line from its point of intersection with another line would also be welcome.

Nonetheless, *LaserCAD* packs an extraordinary amount of power for the money. The next version, scheduled for release sometime around the first of the year, will address some of the shortcomings outlined above. If DSL will polish a few of the program's rough edges and package a well-written guide to getting started, *LaserCAD* may well become the strongest contender in its class.—Jeff Prossie

MATC CAD

MATC CAD is named for the Milwaukee Area Technical College (MATC) where it was developed. One of the first CADD programs for microcomputers, it was written on the Apple II and was designed to emulate the command set of ComputerVision's expensive *CADDS 3* system. MATC had acquired a *CADDS 3* system, but it had only five stations because of the expense. Since the large number of students who wanted to learn CADD could use the system only briefly, the school wrote *MATC CAD* to help students learn the ComputerVision command set. They could then make good use of the ComputerVision system during the short time they

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CIRCLE 476 ON READER SERVICE CARD

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■ LOW-COST CADD



FACT FILE



MATC CAD,
Version 4.26
MATC CAD
1015 North Sixth St.
Milwaukee, WI 53203
(414) 278-6743
List Price: \$195 with
30-day support; \$395

with 1 year of support and software maintenance.

Requires: 256K RAM, two disk drives or hard disk, DOS 2.0 or later. 8087/80287 co-processor recommended.

Supports: Hercules monochrome graphics card and compatibles; IBM CGA, EGA, and compatibles; Technic Graphics Master, Microsoft Mouse and compatibles, Kurta Series I and Pen Mouse; Summagraphics MMI201; Tandy GT2000 IBM joysticks. Dot matrix printers.

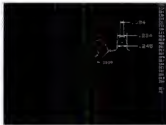
In Short: Not easy to learn and not excitingly documented—but a program with very powerful geometric commands, including 32 ways to draw a line and dozens of ways to place points, circles, and other figures. Yet *MATC CAD* lacks two surprisingly basic features: cross-hatching and color. It is quite fast. Not copy protected, but a licensing agreement is required.

CIRCLE 663 ON READER SERVICE CARD

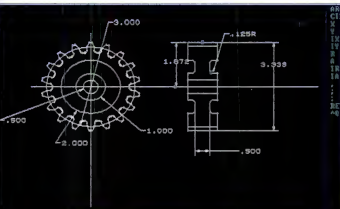
had access to it.

Hence *MATC CAD* was originally designed not as a production CADD system but rather as a learning tool. It has most of the 2-D commands of Computervision's *CADDS 3* but does not read or write Computervision files.

As the IBM PC gained popularity, the school began to realize that *MATC CAD* was at least the equal of many commercial microcomputer CADD systems. *MATC* is therefore taking steps to package and market the product more aggressively. It offers an excellent trial program: send \$3 and get a version of the program that does everything but plot. *MATC* also plans to release a program called *MATIX* that costs \$495 and emulates the 2-D portion of Computervision's *CADDS 4X*. *MATIX* will also remedy most of *MATC CAD*'s deficiencies, such as lack of cross-hatching and user commands. Meanwhile, you can purchase *MATC CAD* for \$195 with 30-day support or for \$395 with 1 year of support and software maintenance.



MATC CAD offers powerful features for constructing the gear. Using parallel and perpendicular lines, I was able to place the main points of the gear tooth rapidly. The powerful Arc and Fillet commands joined the points, while Mirror Copy determined the second side of the tooth. Next I used Rotate Copy to produce a circular array of teeth, then placed the dimensions on the circle.



New Part=N; Old Part=O; Recover=R; Goodbye=G;
Reply=R
-JGEL Recovered
SINS LDM NEN:End 888ig NEN&
SINS RDM:End 888ig DFN

Construction lines to the right of the gear determined the shape of the cross section. Then I used the Insert Line Perpendicular and Insert Line Parallel commands to draw the shape and the Trim command to refine it.

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those
who
may
have
missed
it!

We at Bedford have always said we have a pretty special accounting program, one that combines functionality with useability. If you have been shopping for an automated accounting solution lately, you are likely overwhelmed by the number of software publishers who are making similar claims of their products.

Not all the claims can be true. In an effort to help clarify the offerings, PC Magazine, in conjunction with Price Waterhouse, published the results of an exhaustive survey of 59 top accounting packages. It was compiled from the results of a jointly developed testing script, used to evaluate more than 300 features and requiring 35 hours of hands-on testing for each program.

On September 15, 1987, nearly five months later the study was made public. If for some reason, you could not read that issue, the following excerpts should give you some idea of what you've been missing.

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■ LOW-COST CADD

GETTING STARTED *MATC CAD* is packaged for use in schools. It comes with a 167-page instructor's manual complete with a sample syllabus, quizzes, examples, and implementation instructions for both the Apple II and IBM PC versions of the product. There is also a student manual, which is divided into 14 units and includes lab exercises; a 26-page "Getting Started" installation manual; and a laminated quick-reference card.

No separate reference manual is included, however; to look up a command, you must find it in the index of the student manual and refer to the appropriate lesson. The software comes on a single diskette. Loading and configuring the system for my hardware took less than 10 minutes—although I had to call *MATC* to learn that the driver for the Mouse Systems mouse on my system had to be activated separately before running *MATC CAD*. I called *MATC* several times with questions; each time I was connected with someone who really knew the software and was patient.

MATC CAD creates a scratch file on the hard disk and stores the drawing in it after every zoom and every 15 minutes. You can set the size of this scratch file with the *CONFIG* program. I reached its default size limit while constructing the gear drawing, and had to enlarge the file size. After I received a warning message, I had to leave *MATC CAD*, enter *CONFIG*, enlarge the file (by a simple menu selection), and restart the program.

The first time the scratch file filled up, my system froze, requiring a cold reboot. But the recovery facility, which keeps a copy of the drawing on disk, is wonderful. Amazingly, almost nothing was lost from my drawing thanks to the disk buffering arrangement.

USING *MATC CAD* Although my familiarity with the Computervision *CADD* 3 instruction format (which served as a model for the *MATC CAD* syntax) helped me get started on *MATC CAD* quickly, it didn't make me like it. The system requires a "sentence" for each action; a sentence consists of a verb (like *insert*, *move*, or *trim*), followed by a noun (like *line*, *circle*, *arc*), followed by an optional modifier (like *tangent to* or *perpendicular to*), usually followed by a colon. The colon tells

the system that you've entered the acting part of the sentence and that what follows indicates the specific items or locations to be acted upon.

You select geometric entities (like points or lines) with the screen cursor. You can either use the cursor to point to locations on the screen or simply enter absolute, relative, rectangular, or polar coordinates. *MATC CAD* uses single-precision floating-point numbers for coordinates, giving it all the precision most design and drafting professionals would need.

■ *MATC CAD* really shines in the area of geometric construction. It offers 32 ways to draw a line, as well as dozens of ways to place points, circles, and other figures.

MATC CAD allows you to mask entities and locations. In other words, you can tell the system you are interested only in points, lines, or some other object; or you can tell the program that you want it to consider all the items in the rectangular window that you define. Commands and masks stay in force until replaced.

You can make selections using a mouse, a Kurtz tablet with a tablet menu (provided with the *MATC CAD* package), or the keyboard. An improper entry gets you a slash and a beep, indicating that *MATC CAD* is ignoring your entry. There is no on-line help facility.

Plotting is reasonably flexible, although *MATC CAD* does not allow you to autoscale plots, and the number of plotter drivers is limited.

Despite its remarkable flexibility, *MATC CAD* lacks two surprisingly basic features of *CADD* software: cross-hatching and color. It's hard to believe that a modern microCADD program doesn't fill or crosshatch—or draw in color. The pro-

gram has no Undo command, although it does have an *Unerase*. There are no ellipses, only one type of dimension arrowheads, and only two line types available.

TEST DRAWINGS *MATC CAD* shines in the area of geometric construction. The rigid and somewhat daunting syntax comes into its own here: it offers 32 ways to draw a line and dozens of ways to place points, circles, and other figures. Making liberal use of modifiers, such as *perpendicular* and *parallel*, I rapidly placed the main points of a tooth in the gear drawing.

Because the program offers an axis of symmetry, I needed to construct only half the gear tooth. To complete the tooth, I used the powerful *Arc* and *Fillet* insertion commands to join points, then invoked *Mirror Copy* to duplicate the other side of the tooth. The *Rotate Copy* feature allowed me to produce a circular array of 18 teeth. Placing the concentric circles of the gear shape with *Insert Circle* was simple.

Using construction lines to the right of the gear drawing helped me block out the shape of the section. With *Insert Line Perpendicular* and *Insert Line Parallel*, I drew the shape, and then used the powerful *Trim* commands to refine it.

But, as previously mentioned, *MATC CAD* offers no cross-hatching. While it is possible to create the required hatch pattern out of lines, the process is unnecessarily cumbersome.

I produced the gear detail by using *Move Copy* to extract a portion of the gear. Then I used the dimensioning commands to complete the drawing.

Changing the size of the gear was not easy; the only types of objects you can scale in *MATC CAD* are figures—the *MATC CAD* symbols—and inserted parts, which are the drawings themselves. While figures and parts are easy enough to generate and store, you have to know their exact names when you want to retrieve them: there is no directory.

Composing the architectural drawing was relatively easy, though the lack of double-line creation and double-line intersection commands made the task more difficult than it might have been. The challenge was to use the *Trim* command creatively to compensate for these deficiencies.

PC-NC: SERIOUS STUFF

Roland DG's new Micromodeler/CAMM-3 system allows you to take a 3-D CADD drawing and create a physical model from it. With this product, the PC makes another foray out of the office and into industrial applications.

It's been interesting over the last couple of years, watching the PC edge out of its office-bound role in business, into the much broader range of what might be called industrial applications.

Jobs such as CAD (computer-aided design), MRP (manufacturing resources planning), robotics work using machine vision, and now CAM (computer-aided manufacturing) are good examples—all had been considered minicomputer-level applications.

Among the factory-floor-level operations, PC-NC, for "personal-computer-driven, numerically controlled machining," is one of the latest CAM jobs to blossom on the PC. Basically, PC-NC means that you can draw a tool or a part with a three-dimensional modeling package and translate that drawing into commands that control a milling machine. This in turn makes an actual model of the part.

Roland DG, well known for high-technology ventures ranging from PC plotters to music synthesizers, has pushed the PC-NC market forward a bit with its new *Micromodeler/CAMM-3* system.

Consisting of an extremely well-designed software package developed by another firm and a high-precision, Roland-designed-and-built computerized milling machine, Roland's entry in the computer-controlled machining derby combines ease of use with substantial power. It's a way beyond the low-end training tools offered by others and moves squarely into the low-volume modeling and prototyping systems market—yet at \$18,000 list (plus a PC AT or compatible), it's a fraction of the price of other entries of similar potential.

The software component, *Micromodeler* (a subset of Point Control's widely



FACT FILE

Micromodeler

Roland DG
Division of Roland Corp., U.S.
7200 Dominion Circle
Los Angeles, CA 90040
(213) 685-5141
List Price: \$1,995; CAM Connection,
\$1,000.

Requires: 640K RAM, hard disk, 286 or 386 computer, EGA or VGA display, video card, DOS 2.0 or later, 80287 math coprocessor recommended.

In Short: An extremely well-designed software package that takes the PC out of the office and into industrial applications. Copy protected.

CIRCLE 6 ON READER SERVICE CARD

CAMM-3

Roland DG
Division of Roland Corp., U.S.
7200 Dominion Circle
Los Angeles, CA 90040
(213) 685-5141
List Price: \$14,500

In Short: An impressive high-tech machine scaled down to desktop size.

CIRCLE 7 ON READER SERVICE CARD

used, much more expensive *Smart CAM*), costs \$2,995 and runs on a hard-disk-equipped PC. You'll want a 286 or 386 machine and either an EGA or a VGA display and video card. A math coprocessor chip won't hurt, either; by their nature, CAD/CAM programs are calculation intensive, which the coprocessorless world spells *s-l-o-w*.

THE MODULAR APPROACH *Micromodeler* consists of the following modules: first there is Job Plan, which allows the user to build an inventory of available tools (what the home handyman would call drill bits) and lists their

physical characteristics. Next, *Shape*, a very nice little true-3-D CAD program, is used to draw the objects to be machined. CAM Connection is a utility that allows direct import of files from *AutoCAD*, *Cadkey*, *VersoCAD*, *Computervision's Personal Designer*, and a few other packages; it also imports files from programs such as *Generic CADD*, (which can write DXF files), and can export the files developed in the *Shape* module to the above-mentioned programs. Finally, *Run CAMM-3*, which plots the milling work, actually writes the code to control the milling unit and drives the CAMM-3 machine.

The \$14,995 CAMM-3 machine, the hardware part of the kit, is an impressive—and impressive-looking—piece of high tech scaled down to desktop size. It accepts raw materials such as wood, plastic, or aluminum in blocks up to 6 by 7 by 7 inches (HWD) and tools (remember: bits) with shank diameters from 1/8 inch to 3/8 inch. However, you'll lose an inch or so to spindle length and are thus limited to material up to about 5 inches thick. Five-digit LED readouts indicate head positioning in the x, y, and z (third-dimension) axes. CAMM-3's controller includes pause functions, easy-to-use rotary-dial analog controls for fine positioning, and the other controls necessary for true production-quality tolerances.

The combination is a delight to use and reflects good system design. Since *Micromodeler* spools its CAMM-3 output, you're not sitting waiting for the CAMM-3 to finish its diagonal, back-and-forth, or spiral traces so that you can go to work on the next job. For that matter, once it's figured the tool path (stay tuned), *Micromodeler* gives you a ballpark estimate of the time required to finish the machining.

PLOTTING IN 3-D A good way to think of the CAMM-3 unit is as a three-dimensional plotter. *Micromodeler's* instructions to CAMM-3—an ASCII plain-text file editable with any standard word processor, with code understandable after a few minutes' orien-

tation—are actually much closer to Hewlett-Packard's HPGL plotter language than to the G&M instructions usually used in CAM work.

Not only are you dealing with *x* and *y* axes, as in most drafting work—you must also think in that third *z* dimension

of depth. The *Micromodeler* software is helpful here and makes the bridge from 2-D experience to 3-D part designing relatively easy.

One trick to master is thinking in terms of what CAM people call geometry versus tool path. *Geometry* involves the physical dimensions and the location of points on the fixture or block of material to be worked; *tool path* is literally the step-by-step description of where the tool is to go next to do its work.

Continuing the plotter analogy, just as a well-designed one-pen plotter will stop and wait politely for you to insert a pen of a second color or point width, then resume working, the CAMM-3 unit is smart enough to detect a tool-change instruction, stop for tool swapping, and then resume its work with a (specified but not tested) positioning accuracy of .0001 inch.

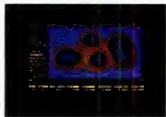
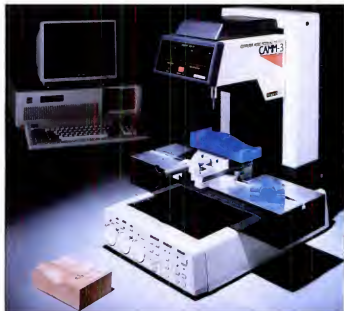
Roland has about 100 *Micromodeler*/CAMM-3 setups in place, applied in a great variety of ways. Most of them are being used to build models, some for very low quantity production work, some for preparing molds, and some for specialized training in educational institutions.

At Nabisco, for example, engineers are using the Roland system to make molds for new plastic cookie trays. Schlage uses it for developing prototypes of new locks. Eastern Tennessee Baptist Hospital uses a CAMM-3 to turn out customized lead shields for patients undergoing radiation therapy.

If you're new to CAM work, *Micromodeler* and CAMM-3 will take some getting used to, though the learning curve is relatively short. But few Roland buyers will be new to CAM; this is a serious system for serious work.

It's also a fascinating example of how PCs are becoming breakthrough tools, delivering superior functionality at a small fraction of the cost of earlier systems. —Jim Seymour

Jim Seymour is a contributing editor of PC Magazine.



Think of the Roland DG Micromodeler/CAMM-3 system as a 3-D plotter. Just as drivers control the two-dimensional motion of a pen plotting a CADD drawing, Roland's *Micromodeler* software controls the three-dimensional path of the CAMM-3 milling machine's tool as it carves a part designed with a 3-D CADD package. Above is the CAMM-3 milling machine, as well as a screen shot of an initial part design (left) and the finished wax part made from it (right).



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CIRCLE 127 ON READER SERVICE CARD

COMPARISON WITH AUTOCAD *MATC CAD* is no friendlier than *AutoCAD*. However, it has real splines, while *AutoCAD* does not. And *AutoCAD*'s command syntax is not as consistent as *MATC CAD*'s, though both are rich in geometric construction capabilities.

Our tests showed that *MATC CAD* was discernibly faster on most operations than most of the products reviewed here. Its screen redraw time was 8 seconds and its delete time was 5 seconds; these times were second only to those of *In*vision*.

Of course, at \$195, *MATC CAD* is much less expensive than *AutoCAD*. And if *MATIX*, the upcoming commercial version of *MATC CAD*, lives up to its promise, it will be a very powerful and inexpensive system.

MATC CAD is a diamond in the rough. Its powerful and consistent command syntax is great, but the program lacks important features such as color, line types, arrowhead variety, and cross-hatching. Perhaps the commercial product will have the needed polish. But for training users of Computervision's *CADD3*, there is no less expensive product.—Joel N. Orr

ProDesign II

ProDesign II, from American Small Business Computers, is a complete CADD package with a full complement of construction geometry, drawing aids, and editing commands that seems designed to zero in on *AutoCAD*'s market. Its lower price (\$299.95) and plentiful features make it a serious contender. But, like *AutoCAD*, its major deficiency lies in its documentation and user friendliness.

When *ProDesign II* comes up, it looks suspiciously like *AutoCAD*, with a root menu displayed on the right, the word "COMMAND:" in the lower-left-hand corner, and a blank drawing area filling most of the screen.

You enter drawing entities by typing in a command, selecting it from a series of hierarchical menus, or by placing points with a mouse or a digitizing pad and then generating the entity with a single-letter command code. As with *AutoCAD*, navigating the menus is less than intuitive, and the commands and command codes could



FACT FILE

ProDesign II, Version 2.5
American Small Business Computers
118 S. Mill St.
Pryor, OK 74361
(918) 825-4844
List Price: \$299.95

Requires: 512K RAM (640K recommended), two disk drives (hard disk recommended), DOS 2.0 or later, 8087/80287 math co-processor recommended.

Supports: AT&T 6300; AT&T Display Enhancement Board; Control Systems Artios 1 and 2; Everex Micro Enhancer Deluxe; Hercules monochrome graphics adapter and compatibles; IBM CGA, EGA, VGA, VGA, or compatibles; Persys BOB; Photon Mega board; Sigma Designs Color 400; Tandy 2000; Tandy Deluxe display adapter; Tecmar Graphics Master; Toshiba 3100; Tseng EVA 480; Video 7 Vega and Vega Deluxe; Wyse WY-700; Microsoft Mouse and compatibles; Altex AC30 and AC40; Calcomp 2000, 2100, 2500, and 9100; Cherry Digitizer; Geographics Clamp-On Drafting Board Digitizer; GTCO Digi-Pad Type 5A and 7 and Micro Digi-Pad; Hitachi Tiger Pad; Houston Instrument TrueGrid and HiPad; IBM 5083, Kurta Series One and Two; Mitsubishi Grafnet 1; Numonics 2200; SAC Grafbar GP-7 and GP-8; Script (all models); Tektronix 4957. Dot matrix and laser printers; plotters.

In Short: A powerful CADD package with many features, such as associative dimensioning and circular arrays, that will be appreciated by the professional draftsman but may be difficult for the occasional user. Not copy protected.

CIRCLE 64 ON READER SERVICE CARD

be difficult for an infrequent user to remember.

A BEVY OF FEATURES The package offers you the full range of line types, circles (of various specification types), arcs (also of various types), free-form curves, boxes, perpendicular lines, tangent lines, offset lines, and so forth. Snap modes supported include snap-to-element, midpoint, endpoint, nearest point, grid point, and intersection.

Three types of grids are available. You can enter coordinate geometry as absolute, relative, or polar. You can trim, scale, extend, stretch, rotate, copy, move, and par-

tially delete elements as needed. There is also an undo function that saved us from disaster several times.

You can automatically dimension lines in either metric or English, linear or angular units, but you cannot dimension radii. Associative dimensioning is supported. Arrowheads are the only kind of dimension-line terminator offered, and there is only one kind of arrowhead. You cannot modify dimension position and witness lines.

You can also calculate areas and perimeters by surrounding the area to be calculated with temporary lines. A series of cross-hatching and fill functions lets you fill in entities.

ProDesign II offers three text fonts, and more can be created. You can force text into bizarre shapes because you may specify one to four points for aligning text: one for straight text, two for angled text, three to specify a nondefault height and slant, and four to even contort the height and slant further.

PERFORMING THE TESTS Given all this functionality, we were anxious to start drawing the gear. We put a few construction lines in one layer in one color and then started work on one side of a gear tooth in a second color on a second layer. The snap modes made entering the lines, arcs, and freehand curves (which are spline curves) relatively easy. Once we had drawn one side of the tooth, we used a Block command to mirror it and then connected it across the top of the tooth. One tooth down, 17 to go. Next we used the single gear tooth to generate a circular array with an offset of 20 degrees. We weren't able to fillet at the root of the gear, however, because *ProDesign II* will not draw a fillet between a spline curve and another element; instead, we snapped an arc between the teeth at the spline curve. Finally, we threw in the required circles and were done.

To construct the gear section view, we extended construction lines across by snapping to the intersection of the circles with the center line. (We couldn't snap to circle quadrants.) With these construction lines, drawing the section view was not difficult. Nor was adding the fillets and dimension lines.

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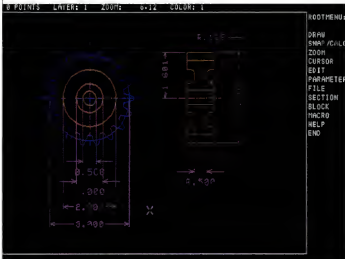
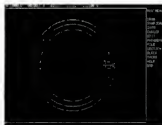
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To construct the first tooth, we used ProDesign II to draw an arc, then mirrored it. The rotational array feature allowed us to create the rest of the gear in a single step. Note that ProDesign II does not let you draw a fillet between a curve and another element, so we were unable to draw one at the root of the gear. Construction lines helped us draw the section view below. We created the lines by snapping to the intersection between the circles and the vertical center line.



The completed test drawing for the gear and its cross section is shown above. The included dimensions are associative. (You also have your choice of dimension—metric or English, linear or angular units.) The arrowheads that you see are the only type of line terminator offered, and you cannot modify the position and witness lines.

To modify the drawing, we moved the gear profile, pitch diameter, and center lines to a separate layer and saved that layer to disk. Then we placed a rubber band box around the gear and increased the scale of the gear by 1.25 times. We saved the layer containing the gear itself to disk. After clearing the screen, we reloaded the saved profile and merged it with the saved, enlarged gear. Redrawing the section view proved easier than modifying it. This example suggests that although ProDesign II can be used to make complex alterations to drawings, performing the alterations can be tedious.

The house plan proved easier than the gear. As in the gear drawing, we could merge other ProDesign II drawings with the current drawing at a specific point and with a specific size and rotation. This made it easy to enter symbols for fixtures, doors, and windows throughout the house.

Materials List is a neat utility included with ProDesign II. You can associate up to 80 characters of information with any drawing entity and also have the package count the number of times that that entity occurs. For example, a plumber might use this feature to draw a plumbing diagram and associate parts numbers with each component of the drawing, then use Materials List to count how many parts of each type there are. The plumber could then transfer this information into a database package to analyze and cost the job. An electronics symbols library also comes with the package.

GETTING OUTPUT ProDesign II will readily export to and import from DXF file formats. It can also import IGES file formats. We exported our gear drawing to a DXF file with a few simple commands and took a look at the results from within AutoCAD. A few colors changed, the center lines changed to solid lines; and some of the dimensions were not displayed. We also loaded the ubiquitous AutoCAD firehose Nozzle into ProDesign II format. It looked reasonable enough, and we were able to make a high-resolution dot matrix printout using ProDesign II's excellent printing feature.

ProDesign II produces very high-quality drawings on a dot matrix printer. The printouts are easy to create and amazingly

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■ LOW-COST CADD

detailed for dot matrix output.

Our main problem with *ProDesign II* lies in the way it interfaces with the user. You won't always find commands on the menus where you would expect them (why is the clear-all function on the Zoom menu?). The single-digit command codes are arcane and difficult to remember. Nor is the documentation user-friendly; for example, to find out how to make the rotational array of gear teeth, you don't look in the index for *Copy* or *Rotate*—instead you look for *command, block circle*.

A good tutorial would make a welcome addition to the manual, though the documentation does include handy illustrations for many of the commands. *ProDesign II* almost forces the occasional user to have the manual open on his lap as he works with the software. The Help command simply delivers a list of commands with brief descriptions; it is not context-sensitive. However, we must give an A to the technical support group: they were most helpful when we called with questions.

We had seen *ProDesign II* in a previous release and were not especially impressed. Version 2.5 has corrected many of the deficiencies, particularly through the addition of a screen menu and capabilities for relative coordinate input, intersection snap, array copy commands, and a series of block or group commands.

INSTALLATION The *ProDesign II* installation procedure is simply a matter of copying the supplied disks into a hard disk subdirectory. The package consists of four disks: one supports a math coprocessor, the second a system without a math coprocessor, and the other two are program and utility disks. You copy only the three appropriate disks.

Since *AutoCAD* itself has a long way to go before it becomes user friendly, we can't say that *ProDesign II* compares unfavorably with *AutoCAD*. The functionality of *ProDesign II* is extensive and can give *AutoCAD* a run for its money in all but the less frequently used capabilities. For example, where *AutoCAD* has the extensive AutoLISP programming language, *ProDesign II* has only a macro facility for recording keystroke sequences. Nonetheless, for all but the most demanding technical draftsman, *ProDesign II* is a

good, inexpensive alternative to *AutoCAD*. [According to *American Small Business Computers*, *ProDesign II*, Version 2.5, was renamed *DesignCAD*, Version 3.0 in early October.]—Donald C. Peckham and Martin L. Ramsey

Pro3D/PC

When you start working with Enabling Technologies' *Pro3D/PC* (\$395), you can prepare to throw out most of what you already know about conventional CADD systems. *Pro3D/PC* is not a drafting package: it has no features for dimensioning, cross-hatching, text entry, or many other requirements of a professional production drafting system. Rather, it's a true three-dimensional modeling system for engineers, desktop publishers, architects, and graphics or industrial designers.

With either a mouse or your keyboard, you can use *Pro3D/PC* to design and manipulate full-color 3-D objects. The package runs under the *Microsoft Windows* environment and includes a run-time version of *Windows*.

Pro3D/PC makes good use of this environment, with windows that you can reduce to icons or just reduce and move around the screen. You can point to icons around the periphery of the active window

to manipulate images, change ambient light and perspective, or redraw and revert to original conditions.

You access most other commands via pull-down menus, though their function and placement are not always easy to intuit. You cannot access every command at all times, and when the commands are not available for use, they are shaded gray on the menus. Besides using the menus, you can evoke some commands with single keystrokes.

MICE PLUS You use the Ctrl, Shift, and Alt keys to modify mouse actions in some cases. In the tool mode, if you click the mouse on a "selection rectangle" while holding down the Shift key, you can simultaneously squeeze an entity in one direction and stretch it in the other. If you click the mouse in the middle of a line while depressing the Ctrl key, you'll create a new point that you can drag, with "rubber-banding" between it and the adjacent points. A mouse click on a line while holding down the Alt key activates the line for inserting a curve. Numerous other combinations of mouse clicks and keystrokes are possible. Using the Ctrl key by itself inhibits redraw.

You must select the items you wish to erase—either one or a group. The undo feature applies only to the last action you performed; a second invocation reverses or undoes the undo.

SHAPES Six primitive solids are available directly from an on-screen menu: cube, wedge, and four "spheres" (polyhedra with triangular facets) of various textures. *Pro3D/PC* stores six more shapes (cylinder, torus, pyramid, tetrahedron, cone, and trapezoid) as outline files. All can be enlarged, shrunk, stretched, squeezed, twisted, sliced, hollowed out, cloned, changed to "antimatter," and merged. (Antimatter merges with matter to form nothingness—a great way to make variously shaped holes in objects or to carve away unwanted parts.) You can save the results at any time to add to the library of shapes.

Pro3D/PC allows you to use any combination of eight direct light sources to create custom lighting or alter a preset scenario. You can save or reuse the results.



FACT FILE



Pro3D/PC,
Version 1.00
Enabling
Technologies Inc.
600 South Dearborn St.,
#1304
Chicago, IL 60605
(312) 427-0408

List Price: \$395 (special introductory offer).
Requires: 512K RAM, two disk drives,
DOS 2.0 or later
Supports: All hardware supported by *Microsoft Windows*.
In Short: This is not a tool for making manufacturing drawings; it is a powerful and straightforward tool for visualizing, creating, and printing complex shapes on-screen and on paper. It could be a strong accessory for desktop publishing. Not copy protected.

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- NEW Automatic transactions with monthly, bi-monthly, quarterly semi-annual, and annual frequency options

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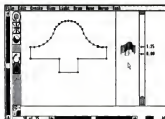
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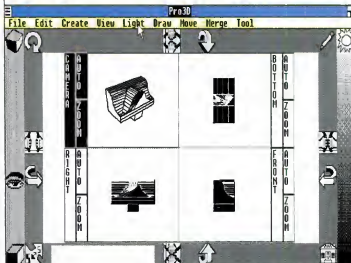


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■ LOW-COST CADD



You construct the 3-D test image with Enabling's Pro3D/PC by forming two parts and merging them. First, you construct a cross section of each shape, extrude it to any length (note the extrusion to the right of the first screen), and save it. You can then move the completed objects anywhere on the screen you want. I merged the cylinders with the objects, then turned them into animatter to fashion the holes in the part. I shaded the final object.



Pro3D/PC allows you to display up to four views of an object at one time. As you can see, Pro3D/PC runs under the Microsoft Windows environment. The icons at the perimeter of the screen perform various functions; for instance, the pencil indicates a redraw, and the angle of the eye indicates the perspective from which the objects on the screen are viewed.

TOOLS Two handy tools in the Create menu are Lathe and Profiler. Using Lathe, you can create radially symmetric objects from a 2-D cross section. Profiler enables you to create irregular objects by manipulating individual cross sections. We uncovered a bug in the program that limits the number of line segments (including those making up an arc) to 130. Enabling Technologies confirmed the bug and told us that it is being corrected.

Both Lathe and Profiler activate the Tool menu, which gives you your choice of such tools as units, axes, grids, and dimensions. The menu also lets you set units, points per circle, and universe/tool scale.

Pro3D/PC's powerful, easy-to-use editing commands allow you to create almost any shape you can imagine. For instance, you can take cross sections and stretch, squeeze, distort, twist, and drag them in the tool windows.

Two interesting features are Linearize Points and Create Arc. Linearize Points creates a straight line with points equally spaced from a string of connected line segments of random length and direction. Create Arc creates arcs and circles by anchoring a point on the arc, anchoring the center, and then sweeping the desired arc. In addition, you can use it to force a series of connected line segments to follow a curve.

With a lathe cross section or rib completed, you can make it solid and manipulate it in any of seven possible views. You can resize the solid, transmute it to "animatter," align or merge it with other solids, and reorient it on any axis.

Although you can save these object images as Paint, PICT, and PostScript files, *Pro3D/PC* cannot open such files. It saves Paint files as bit-mapped images; these carry color information, but other applications may not be able to use them. The program can save PICT files in either Windows Metafile or Micrografx format. PostScript files can be in either PostScript or EPS format.

COLORS You can specify colors with one of three color models: HLS, HSV, or RGB. HLS (hue, lightness, saturation) and HSV (hue, saturation, value) each provide a palette of 3.6 million colors. RGB (red,

■ LOW-COST CADD

green, blue) provides a palette of 16.7 million colors.

Menus automate the setup/install procedure, but *Pro3D/PC* does not allow you to determine the file paths for the program and other files. You may select from 27 popular printers and 3 HP plotters from within the program. You must rerun Setup to change graphics adapters, pointing devices, or keyboards. *Pro3D/PC* supports many common graphics adapters and enough mice to stampe an elephant herd.

The manual is complete but not ponderous, with clear explanations. The sections lack numbers, but the information is organized logically. The table of contents will generally get you close to the information you want. If not, the index appears to list each important occurrence of words and phrases in both the "Before You Begin" guide and the user manual. The "Guided Tour" lets you try out most operations you will need. You actually produce some fairly sophisticated shapes and assemble them into 3-D art.

The packaging is "hi-tech": the molded inner liner of the manual/box forces you to dig down into a cavity to turn the pages.

SLOW OPERATIONS Keep a novel or other tasks handy while waiting for redraws and merges to be completed. (PC Labs was unable to run the comparative performance tests on this package because the program could not create the 2-D test images; hence we can only give you our subjective feeling for the speed of the package.) Fortunately, you can postpone redraws, telling *Pro3D/PC* to wait until after you've completed a series of manipulations.

The system has an interesting memory management technique. It expects a minimum of 512K RAM and loads as much of the program as possible into RAM for faster operation. As memory demanded by the object you're developing grows beyond a certain size, more and more of the program is swapped to disk. Version 2.0 (a free upgrade for early buyers) will do away with the 640K limitation. File size and speed will then be limited only by the number-crunching ability of the processor, the graphics card, and your patience.

Note: an object, profile, or lathe file re-

mains in RAM until you save it. Save often; your only protection occurs when you quit the system. At that point *Pro3D/PC* tells you if unsaved changes exist, and you must take a separate action to quit.

Pro3D/PC is a valuable visualization, creation, and illustration aid for producing on-screen full-color 3-D images (and printing them) for any number of professional applications. It's an especially powerful tool for desktop publishers as well as engineers, architects, and designers.

—Carlos Pinkstaff

TurboCAD

For \$99, *TurboCAD* offers most of the basics as well as a few nice extras such as an on-screen calculator and a sketch mode. But you must figure out how to use some of the commands by trial and error, and they are implemented in roundabout ways.

DRAWING *TurboCAD*'s entity-drawing capabilities deliver the basics and some advanced features, such as rectangles, ellipses, polygons, and parallel or tangent lines—all necessary for a comprehensive drafting system. Users can easily trim or extend entities. *TurboCAD* also offers a sketch mode that even first-time users will find intuitive.

TurboCAD also offers a unique feature that all CAD vendors should consider. A function key gives you access to an on-screen calculator with a full array of algebraic and trigonometric functions. You can save values in registers for use in drawing functions—a useful feature.

Often, however, it is difficult to determine what features *TurboCAD* offers since you obtain them in odd ways, and they're not fully explained in the manual. As a result, even with *TurboCAD*'s good context-sensitive help, there are many times when you have to figure out how to implement a feature by trial and error.

For example, you won't find a menu choice for circles; rather, you can draw one by specifying an arc with a starting angle of 0 and an ending angle of 360. Similarly, the package offers no mirroring command per se, nor is there an entry for mirror in the documentation's index, but you can mirror the object by moving it with a zero dis-



FACT FILE



**TurboCAD,
Version 1.41**
MSA Group Inc.
8351 Roswell Rd., #185
Dunwoody, GA 30350
(404) 642-4131

List Price: \$99; Architectural Symbols Library, \$29; Mechanical Symbols Library, \$29; Electrical Symbols Library, \$29; Flow Charting Symbols Library, \$29; Home Furnishings Symbols Library, \$29.

Requires: 256K RAM, two disk drives or hard disk, DOS 2.0 or later.

Supports: Hercules monochrome graphics or compatibles; IBM CGA, EGA, or compatibles. Microsoft Mouse and compatibles. Calcomp 2000, 2100, and 2200; GTCC Micro Digi-Pad Type 7; Kurta Series One. Two, and Three; Numonics 2000 series; Summagraphics (all models). Laser and dot matrix printers; plotters.

In Short: An inexpensive CADD package that offers the basics. Its command structure could be better, and its lack of support for a math coprocessor is a significant disadvantage. Not copy protected.

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placement and a scale factor of minus 1.

TurboCAD allows you to create a series of symbol libraries that you can insert into any drawing. But the limitation this faces is that you can insert only symbols from the current subdirectory; if you want to use a symbol residing in another subdirectory, you'll need to make multiple copies. This makes system management harder and wastes disk space.

Some of the features that are available on other systems are missing in *TurboCAD*. For instance, the system offers no polylines. In addition, construction industry professionals will find that the package's inability to express units in feet and inches is a major deficiency. For instance, *TurboCAD* requires that you translate 5' 7 1/4" into 5.6458333 feet.

TurboCAD claims to be the fastest drawing system around among those that do not use a math coprocessor. While that may be true, most of the other packages reviewed here do support one. Therefore, *TurboCAD*'s times on the PC Labs performance tests are among the slowest. Again,

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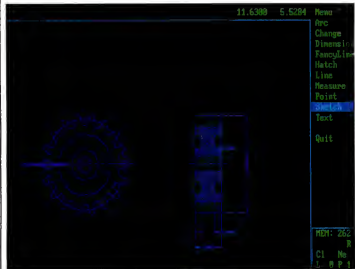
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■ LOW-COST CADD



TurboCAD's Move, Copy, Rotate, and Mirror commands are all useful for creating the gear. But the use of some commands is not immediately obvious; for instance, to use the Mirror command, you move an object giving it a zero displacement and a scale factor of -1. Notice that when you dimension concentric circles, the dimension labels overwrite each other.



Even for the relatively simple architectural drawing, I found TurboCAD's editing commands to be cumbersome. For instance, to delete an entity, you must draw a window around it, position the cursor over the item, strike the Del key, and type in the name of the entity type. The program also lacks the ability to express units in feet and inches.

anyone interested in serious production drafting should be willing to invest the money in an 8x87 chip.

EDITING A good rule of thumb is that 80 percent of a final drawing comes from editing the original design. Yet some of TurboCAD's commands require an unnecessary extra step. For instance, to delete a line you must first enclose it within a window. You then position the cursor directly over the item, strike the Del key, and type in the name of the entity type. (That's right: after you have selected the item, you have to tell the system whether it is a line, arc, or whatever.)

TurboCAD's dimensioning capabilities are straightforward but limited. You can automatically dimension horizontal, vertical, or angled lines. Unfortunately, when you're using the radial dimensioning option, you can't move the text; hence, when dimensioning concentric circles, the package will overwrite text. Baseline or continuous dimensioning styles are not available, nor is associative dimensioning. The U.S. distributors for TurboCAD have indicated that a major rewrite of the dimensioning package is in the works for a future release.

The cross-hatching function does exactly what you would expect it to do, though its implementation could be more elegant. While some packages, such as AutoCAD, allow you to select an entity and give a single command in order to crosshatch it, TurboCAD requires you to define the entire boundary of the object with the help of the object snap modes. The package offers you no special hatch patterns. However, you can create line patterns at any angle with any spacing and can hatch nested and complex objects.

You can choose from five standard fonts; pull-down menus make it easy to select them. In addition, TurboCAD offers nine justification modes.

USER INTERFACE TurboCAD commands are selected from 1-2-3-like tree-structured pull-down menus. Context-sensitive help is available at any time. While TurboCAD uses the 1-2-3-like shortcuts of allowing you to type in the first letter of every command to page through the menus, you must follow the menu hierarchy. You

■ LOW-COST CADD

PC EDITOR'S CHOICE

- Drafrix 3D Modeler
- Generic CADD

Generic CADD, Version 3.0 (together with its optional modules), is the best choice for a 2-D drafting program. It is a full-function production drafting system, field-polished and well documented. The price is astoundingly low (\$99.95 for the basic package, \$49.95 for most add-ons), and you don't have to buy the modules, such as Auto Dimension, that may not be of interest (or of use) to you.

On top of that, the program is responsive and programmable and has keyboard equivalents for almost all menu commands. Excellent technical telephone support further distinguishes this product. But what really clinches it is Generic Software's 60-day, no-questions-asked, money-back guarantee.

Drafrix 3D Modeler is the best of the available 3-D programs. While it does not yet have the niceties of the Drafrix human interface, it has enjoyed well-deserved popularity in its original Mega CADD form for years. You can use it to create and manipulate 3-D objects, and it works well in both professional architectural and design environments.

can't execute a command from the keyboard without branching through the menu, nor is there a key that returns you to the top of the menu.

You can access commands using a mouse, or with the cursor keys, or by typing one letter at the keyboard. While tablets are supported, you can use them only as pointing devices; there is no support for a tablet menu.

A status line at the top of the screen displays cursor coordinates and prompts you for input. A status box at the lower-right-hand side of the screen gives the current

status of several useful system variables, including the amount of memory used, the size of the grid, and the current snap mode.

FILE MANAGEMENT *TurboCAD* allows you to store drawings in any directory, but you can only access files located in the same directory as the program. In addition, the package offers pop-up windows for accessing filenames. When I tried to call *TurboCAD* from any directory other than its own, the system kicked me out.

You use standard DOS names, though *TurboCAD* controls their extensions. Unlike many other systems that maintain the entire drawing in one DOS file, each *TurboCAD* drawing consists of a number of DOS files with extension names indicating the entities within. There are separate files for lines, arcs, dimensions, and so forth. If you copy a drawing from one directory to another, be sure to copy all the subfiles, or you'll lose part of your drawing.

TurboCAD offers 128 layers, which should be satisfactory for most applications. A convenient pull-down menu allows you to turn layers on and off. The program allows you to use numbers only as layer names. Alphabetic characters, however, would make it easier for you to remember the contents of layers and would also assist in their management.

The package offers zooms and pans. You can either use preprogrammed zoom factors or use the Plus and Minus keys to zoom in and out. On many occasions, using a zoom "window" changed the aspect ratio of the drawing on the display, though not in the database. While zooming back out corrects the problem, it was annoying. To avoid this, you should zoom with the Plus and Minus keys.

PLOTTING *TurboCAD* allows you to obtain output using printers and plotters. During the install process you can configure several printers or plotters, selected from a pull-down menu at print time.

We chose to use an IBM Proprinter. We had the option of selecting both low- and high-density output during the install. When printing with the high-density option we were more than satisfied with the final output.

You can also plot to a disk file to free up your system. You can then print the file on

■ *TurboCAD* offers 128 layers, which should be satisfactory for most applications. A convenient pull-down menu allows you to turn these layers on and off.

any system that has a compatible output device.

IMPORT AND EXPORT *TurboCAD* allows you to import and export only DXF files. But when you export a file in DXF format, the package converts entities into a series of line segments. To manipulate one of these exported entities, you must perform the function on each segment rather than on the entire entity.

GETTING UP AND RUNNING Installation of *TurboCAD* was reasonably straightforward. The system comes with two program disks and a disk of sample drawings. Defaulting through the recommended options should get you up and running without trouble.

The documentation contains a good tutorial for the product, but it should explain how the commands interrelate to each other. U.S. support for *TurboCAD* is offered by the MSA group in Atlanta, which did an excellent job of answering our questions.

CONCLUSION *TurboCAD* is a solid, inexpensive CADD package with a number of useful features that is somewhat marred by problems with its user interface. Version 1.5, which was not available in time for this review, promises additional features such as macro-writing capabilities, true DXF importing and exporting functions, and a bill of materials function. But the continuing lack of support for a math coprocessor is a significant disadvantage. —David Jordani

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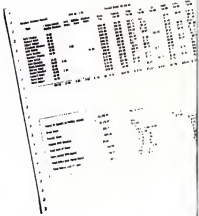
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Hard disk cards have undergone a growth spurt. They're now more in step with the times.

Improved technology for 3½-inch hard disk drives has pushed average access times up to par with some of the best conventional hard disk systems. Capacities have swollen to a point where you can fit up to 50 megabytes into your PC without losing a single drive bay. At the same time, the prices have found parity with those of conventional systems. Today, you can buy a 20-megabyte hard disk card for as little as \$369. Cards packed with nearly 50 megabytes can cost from \$800 to \$1,500.

Another twist of fate has made hard disk cards desirable. The low end of IBM's Personal System/2 line won't accept conventional hard disk expansion. Fitting a 3¼-inch hard disk into the compact IBM PS/2 Model 30 would make the machine look like a boa constrictor that had devoured Big Bird. Hard disk cards have adapted to the new chassis faster than almost any other expansion product.

As recently as a year ago, hard disk cards were reserved for users who were reluctant to touch computer circuitry. Those who were intrepid about immersing themselves in electricity up to their elbows refused to pay the price imposed by the convenience of hard disk card technology.

Dollars weren't the

THE NO-SWEAT WAY TO PUMP UP YOUR PC: HARD DISK CARDS



*Faster performance, greater capacity,
and lower prices give the
once-lowly hard disk cards grown-up
powers and new market
appeal—especially good news for IBM
PS/2 Model 30 owners
in search of expansion.*

only issue. Hard disk cards were notoriously slow, and their storage capacities were paltry.

Not all hard disk cards incorporate the latest improvements. But collectively, the 15 models we look at here reflect all the desirable changes in the technology. They include products from CMS Enhancements; DataZone Services; Maynard Electronics; Mountain Computer; Plus Development; Rodime; Silicon Valley Computer; Standard Brand Products; Systems Peripherals Consultants; Thompson, Harriman and Edwards Computer Products; and Western Digital.

We also reviewed the Standard Brand Flash Card-20 and Flash Card-30, and the Plus Development HardCard 20, which were named Editor's Choices in our previous roundup of hard disk cards, "Sliding in Memory: 14 Hard Disk Cards" (*PC Magazine*, Volume 6 Number 3). In this review, we'll see just how well the new competition stacks up against these old favorites.

NEW SPEED LIMITS

The smallest of the hard disk cards we reviewed is now 20 megabytes; most are 30 megabytes or larger. Although the slowest still creep by more slowly than IBM's 80-millisecond specification for the PC-XT hard disk, some have thoroughly trampled the PC AT 40-millisecond performance barrier.

■ HARD DISK CARDS



Hard Disk Cards: Summary of Features

(Products listed in ascending price order)

	Standard Brand Flash Card-28	Standard Brand Flash Card-30	Gold-Card 21	THE 20-MB Hard Disk Card	Slot TurboDrive	Western Digital FileCard 30	Plus Development HardCard 28	Gold-Card 50
Specifications	\$369.00	\$419.00	\$499.00	\$499.95	\$599.00	\$699.00	\$795.00	\$799.00
Capacity (Mbytes)	20.0	30.6	21.0	20.0	30.0	32.0	21.2	48.7
No. of slots	1½	1½	1½	1½	1	1½	1	1½
Power consumption (watts)	10.0	10.0	6.0	15.0	7.0	12.0	8.0	8.0
Power connection	Direct	Direct	Bus	Direct	Direct	Bus	Bus	Bus
Setup Features								
Preformatting	Low-level only	Low-level only	DOS	Low-level only	DOS	None	Low-level only	DOS
Self-booting ROM	●	●	●	●	●	●	●	●
Configuration to highest drive	Via jumper settings	Via jumper settings	Via jumper settings	Via jumper settings	Via jumper settings and separable cable	Via software	Via jumper settings	Via jumper settings
General Features								
Automatic head park	●	●	○	○	○	○	●	○
Activity indicator on-screen	○	○	○	○	○	○	●	○
Works with hard disk	●	●	●	●	●	●	●	●
Controls hard disk	●	●*	●	●	●	●	○	●
Works with 2nd hard disk card	●	●	○	●	●	●	●	●
Controls 2nd hard disk card	●	●*	○	●	●	●	○	○
Compatibility								
XT	●	●	●	●	●	●	●	●
AT	○*	○*	○	○	○	○	○	○
PS/2 Model 30	● (2 slots)	● (2 slots)	● (1½ slots)	○	● (1 slot)	● (1½ slots)	● (1 slot)	● (1½ slots)
Miscellaneous								
Warranty (years)	1	1	2	1	1	1	1	2

PC indicates Editor's Choice ●—Yes ○—No *The Standard Brand Flash Card-30's controller will work only with RLL drives. *The Slot TurboDrive 47 will delay-chain up to seven other SCSI devices. *Products may work in this system, but it is not recommended. *The Mountain Computer DriveCard 50 is compatible with the PS/2 Model 30 only as a single disk drive. It will not coexist with another hard disk.

All the improvements in hard disk cards have the same genesis—the maturation of the technologies involved in making the 3½-inch hard disks on which the cards are based, coaxed along by ever-shrinking computers like the IBM PS/2 series.

Manufacturers have endowed these little drives with all the features of their full-size counterparts, including high-performance servo-voice coil head actuators and automatic head parking and locking to prevent head crashes during and after power-down. To increase capacity, they have embraced run-length limited (RLL) data encoding; they have filled drive chambers with up to four tiny platters and squeezed


ever more tracks onto each one. The HardCard 40, from Plus Development, has even outdistanced DOS's track-handling capacity, and it uses a big-disk trick to make all 1,224 tracks usable.

Many hard disk cards now offer a number of the larger systems' installation options for optimizing performance. Several products include low-level-formatting utilities with options for adjusting the sector interleave. With this facility, you can match the speed of your disk to your computer's ability to handle its data. Systems Peripherals Consultants' ScoreCard 47 goes so far as to back its one-to-one interleaving with on-board buffering, for even

better performance in handling transfers of large blocks of data.

UNCHANGED ASPECTS Some aspects of contemporary hard disk cards remain the same as before the maturation of the products. All invariably use an XT-style 8-bit interface. The narrow bus allows them to fit inside any model of IBM or compatible computer, except for those using Micro Channel Architecture. But it imposes a performance penalty in full 16-bit systems, such as the AT and the XT Model 286, with which many of these systems are compatible.

Most hard disk cards are still power-

						
CMS Drive Plus 48	Maynard Onboard 30	Mountain Computer DriveCard 50	PC Development HardCard 48	ScoreCard 47	Rodime R-Card 45	Slot Ultra-Drive 47
\$895.00	\$995.00	\$1,095.00	\$1,195.00	\$1,295.00	\$1,495.00	\$1,499.00
41.8	31.0	48.7	42.3	47.0	45.5	47.0
1½	1½	2	1	1½	1½	1
10.0	10.0	9.8	8.0	13.0	17.0	8.0
Bus	Bus	Bus	Bus	Direct	Direct	Direct
DOS	Low-level only	Low-level only	Low-level only	None	None	DOS
• Via jumper settings	• Automatic	• Via jumper settings	• Via jumper settings	• Via jumper settings	• Via jumper settings	• Automatic
○	○	○	●	○	●	●
○	●	○	●	○	○	○
●	●	●	●	●	●	●
●	●	○	○	●	●	●
●	●	●	●	●	●	●
●	●	○	○	●	●	●
●	●	○	○	●	●	●
●	●	○	○	●	●	●
●	●	○	○	●	●	●
● (1½ slots)	● (1½ slots)	● (2 slots) ⁹	● (1 slot)	○	● (1½ slots)	● (1 slot)
1	1	1	1	1	1	1

hungry. Few can squeak by on the limited current available inside the standard PC equipped with a 63.5-watt power supply; most demand that you upgrade the power supply in such computers. Fortunately, the process is easy (it requires wrestling with only four screws). And replacement power supplies in the range of 135 to 150 watts are affordable, with mail-order prices as low as \$42. Moreover, any PC will benefit by the power supply transplant, even if you don't install a disk card.

Drives still get their power either from the PC bus or directly from the power supply. Getting power from the bus simplifies installation; you merely slide the disk card

into place. But if the drive is particularly thirsty, this method may put an inordinate load on the modest conductors of the PC bus. Getting power directly, although it involves adding extra cabling and a wye adapter, is the preferable method from the power-routing perspective.

The other problem with sliding a hard disk into an expansion slot is that—with one exception—hard disk cards are wider than a single expansion slot. Plus Development's HardCards remain the exception.

The other drives rely on two techniques to minimize space requirements. Nearly all of them allow you to slide a half-length expansion card into the adjacent slot. Sev-

eral hang their wider section, containing the hard disk, out on the left-hand side (when viewed from the front of the host computer). When you install one of these hard disk cards in a PC or XT, you can crowd it into slot 1 (the leftmost slot) by moving the loudspeaker mounting bracket to the front of the floppy disk adapter slot (where it fits nicely because the adapter is shorter than a full expansion slot). Maynard Electronics goes further by including extra hardware and speaker extension wires with its system.

A few of these hard disk cards have developed the undesirable tendency to overflow their nominal slot in both directions.

■ Improvements in hard disk cards have the same genesis—the maturation of the technologies involved in making the 3½-inch hard disks on which the cards are based.

Not only do they limit one adjacent slot to holding a short expansion card, these hard disk cards impinge on the slot on the other side, restricting the height of the board you can fit there. Relatively tall expansion boards, such as some internal modems, won't fit in a drive equipped with such a hard disk card.

With all the improvements, deciding between a hard disk card and a conventional hard disk subsystem is more difficult than ever. On balance, you have fewer reasons than ever to disregard the easy-to-install cards and less incentive to tangle with full-size systems. One of the improved hard disk cards may be the perfect mass storage system to add to your PC or PS/2 Model 30.

The following reviews, assembled in alphabetical order according to company name, will help you decide which hard disk card is best suited to your needs.

■ HARD DISK CARDS

CMS ENHANCEMENTS INC.

CMS Drive Plus 40

Among the first hard disk cards compatible with the PS/2 Model 30, the \$895 CMS Drive Plus 40, from CMS Enhancements, is a well-made, sturdy product that would benefit any PC or PS/2 Model 30 lacking the capacity and speed of a hard disk. Otherwise it rates a yawn. The card's 40-megabyte capacity has been easily outdistanced by other products, and its laggardly speed nixes it as a performance choice.

The Drive Plus 40 mates a tiny 3½-inch Tandon hard disk with a Scientific Micro Systems controller card, using an elaborately fabricated mounting bracket made of pale beige-finished metal. To supplement the strength of the bracket (by itself stronger than most), CMS Enhancements takes the unusual step of gluing two rubber feet at its bottom. The Drive Plus 40 for the PS/2 Model 30 uses a slightly different bracket than the PC model does but they are functionally identical.

Like most hard disk cards, the Drive Plus 40 steals a slot and a half from your system—one full-length slot and half of the adjacent slot. It leaves enough room for a short expansion card to the right of the drive controller. In the Model 30, it slides into the middle slot, leaving the bottom slot free and the top one half-full.

The Tandon drive in the Drive Plus 40 uses the industry-standard ST506 interface and ordinary modified frequency modulation (MFM) data encoding, relying on the six surfaces of the drive instead of ad-



The CMS Drive Plus 40 consists of a 3½-inch Tandon hard disk coupled with a Scientific Micro Systems controller card. The components are supported by a sturdy, elaborately fabricated mounting bracket. The unit takes up a full-length slot and a half.

vanced data coding techniques to deliver all its megabytes. The band-stepper head actuator of the Tandon drive turned in the slowest performance of all the hard disk cards examined here, creaking along at about 100 milliseconds. To add to the indignity, the heads of the Tandon drive do not automatically park and lock when you turn off the drive.

According to CMS Enhancements, the Drive Plus 40, like earlier CMS models, is among the most electrically frugal hard disk cards, consuming only 10 watts of juice from its host. That's a good trick, considering that the Tandon drive alone (without the SMS controller electronics) consumes 12.5 watts. Whatever its power needs, the Drive Plus 40 gets them filled from the PC bus.

Normal installation of the Drive Plus 40 requires setting no jumpers on the controller card. Configuring the Drive Plus 40 as the second hard disk—drive D:—requires setting only two jumpers on the controller card. The only additional step is that you must unscrew the SMS controller card from the CMS mounting bracket to access the jumpers.

No software comes with the Drive Plus

40 because you need none to supplement the disk utilities included with DOS. When the Drive Plus 40 arrives, you have to partition it with FDISK and use the DOS FORMAT utility to get it running. DOS 3.3 will give you access to the disk space

■ **Configuring the CMS Drive Plus 40 as the second hard disk—drive D:—requires setting only two jumpers on the controller card.**

above the 32-megabyte DOS barrier, if you use FDISK to configure it as an "extended DOS partition." This disk space earns its own drive letter.

If you need to low-level-format the drive, you use a program built into the firmware of the controller card. You can



FACT FILE

CMS Drive Plus 40
CMS Enhancements Inc.
1372 Valencia Ave.
Tustin, CA 92680
(714) 259-9555
List Price: \$895

Requires: DOS 2.0 or later.

In Short: A 41.6-megabyte hard disk card with 60-millisecond performance. Separate, similar models adapt to both PCs and the PS/2 Model 30.

CIRCLE 678 ON READER SERVICE CARD

■ HARD DISK CARDS

access (and run) it through the DOS DE-BUG utility.

The Drive Plus 40 is solidly assembled and well engineered, but some of the details could be improved, and it could use a more realistic view of its power requirements—or a better hard disk entirely. Nevertheless, although better-performing drives are available, the Drive Plus 40 can serve you ably.

■ DATAZONE SERVICES

Slot TurboDrive and Slot UltraDrive 47

Although assembled by DataZone Services, a company directed by the self-proclaimed inventor of the hard disk card, the Slot TurboDrive (\$599) and the Slot UltraDrive 47 (\$1,499) are different from most products in this category. They are not self-contained units that slide a hard disk and controller into a PC expansion slot. Both the Slot TurboDrive and UltraDrive



The DataZone Slot TurboDrive (left) and Slot UltraDrive 47 (right) will take up three half slots if the hard disks are clamped onto the controller cards (as shown above). But a clever mounting mechanism makes it possible for you to open the unit and suspend the disk next to the half-slot controller card, allowing the unit to take up one full slot.

can be inserted attached to their controller cards (although they take up three half slots in this configuration), or as unusual "hang drives," essentially compact disk subsystems with a clever mounting mechanism that allows them to hang suspended above the slot next to the half-slot controller card.

Each product arrives as a rather shaky assembly, with its tiny hard disk linked to its controller or adapter card by a thin, flexible metal bracket. The bracket gives no feeling of security, but that's all right because normal installation requires unscrewing the drive from the bracket and then attaching the disk drive itself to the host computer's chassis, using a novel bracket. Tightening the bracket to the drive pinches the chassis in between, firmly clamping the drive to the host chassis. This mounting scheme is more secure than that used with most hard disk cards, but it requires a bit more dexterity and effort.

If you can find sufficient free space inside your computer chassis and can stretch the cable from the controller far enough, the hang drive will require only a single expansion slot. But the short lengths of cable attached to the assembly limit placement

choices for the drive. This drawback is compounded by the need to keep the drive close to the power supply because it requires its own supply of juice drawn through a factory-supplied wye cable. In addition, the metal bottom bracket, which holds the drive to the controller during shipping but is difficult to remove, may interfere with the use of the adjacent expansion slot.

The 30-megabyte Slot TurboDrive system is based on a 3½-inch Miniscribe hard disk with a nominal capacity of 20 megabytes. It achieves its full 30 megabytes through RLL technology and a Scientific Micro Systems disk controller. This system is, at best, unremarkable. Although it performs within XT specifications, the drive drags along with a 76-millisecond average access time. It does not park its heads at power-down.

The 47-megabyte UltraDrive has a Fuji SCSI disk drive and a simple SCSI host adapter card. With SCSI interfacing, the hard disk and controller are integrated into a single unit. The system looks lightning-fast when its average access time is tested with direct hardware control. But going through DOS puts performance within 20



FACT FILE

Slot TurboDrive

DataZone Services
Division of CPM Co.
P.O. Box 1045
Woodland Hills, CA 91365
(818) 704-4955

List Price: \$599

Requires: DOS 1.0 or later.

In Short: A 30-megabyte hard disk card with a mounting difference: it can either be installed in a slot or hung inside the computer chassis. Delivers average performance.

CIRCLE 67 ON READER SERVICE CARD

Slot UltraDrive 47

DataZone Services
Division of CPM Co.
P.O. Box 1045
Woodland Hills, CA 91365
(818) 704-4955

List Price: \$1499

Requires: DOS 3.0 or later.

In Short: A 47-megabyte hard disk card that uses the SCSI interface, allowing other devices to daisy-chain to it. It can be mounted either in an expansion slot or hanging inside a PC chassis.

CIRCLE 68 ON READER SERVICE CARD

■ HARD DISK CARDS

percent of the 30-megabyte system—adequate but not exemplary.

The support materials for both systems are a confusing jumble. The hopelessly labyrinthine documentation will provide little help to novices and even less meaningful information for the experienced. Fortunately, the drives are preformatted and the system factory-configured to plug-and-play in most systems, so you may be able to get by without guidance.

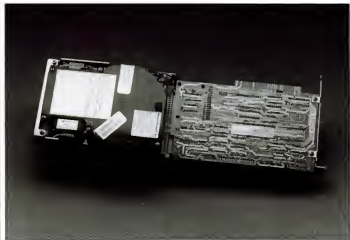
The quality of the components in these systems is very good. Yet the Slot TurboDrive and the UltraDrive perform near the slow side of the "average" range and installing them is more difficult than with most hard disk cards. DataZone Services may have invented the hard disk card, but it has done nothing to perfect it. Choose these drives when you need the benefits of their unusual mounting schemes.

■ ■ ■ ■ MAYNARD ELECTRONICS

Maynard Onboard 30

Although it bears the same designation as a unit we reviewed about a year ago, Maynard Electronics' Onboard 30 is a \$995 hard disk card that incorporates the latest technology. The upgraded model has the best of the new and the old, retaining the earlier product's versatility and strong support.

The earlier Onboard 30 used a JVC drive and MFM data coding. New to the Onboard 30 is the 3½-inch Fuji Electric disk drive with a nominal 20-megabyte capacity and RLL data coding, courtesy of a



The Maynard Onboard 30 uses a 3½-inch Fuji Electric disk drive with a nominal 20-megabyte capacity and RLL data coding via Maynard's proprietary controller. A sheet-metal chassis supports the controller and hard disk, which take up one to one-and-a-half slots.

revised edition of Maynard's proprietary hard disk controller.

RLL data coding brings a faster 7.5-millisecond data transfer rate and allows the use of a smaller, less-complicated hard disk drive. The new Fuji disk drive features automatic head parking and a faster average access time than that of the JVC unit. Its 66-millisecond tested time puts it in the midrange, perhaps slightly on the slow side, when compared with other hard disk cards.

The Fuji drive consumes more power than the JVC drive consumes. The Maynard documentation states that the power consumption of the Onboard 30 is 12 to 14 watts (over the phone the company claimed it to be only 10 watts), although the rated consumption of the Fuji drive alone is 14.1 watts. All this power comes through the expansion bus of the host computer.

Like the previous model, the current Onboard 30 is easy to set up and versatile in use. You can install it as either the first or the second drive, without resetting jumpers or making other adjustments. In addition, the Maynard controller can take over the duties of the existing controller in a computer already equipped with a hard

disk, saving a slot and possibly improving performance because of its RLL encoding. Note, however, that the RLL data coding may prevent using the Maynard controller with existing XT hard disks, since most of them are not RLL rated.

You can also bypass the Maynard controller and run the disk drive directly from the existing combined-hard-and-floppy disk controller in ATs. This strategy reduces the capacity of the drive to 20 megabytes (the IBM controller does not support RLL). However, the Onboard 30 can be installed in ATs "as is" for full-capacity operation with RLL.

The Onboard 30 mounting system has not been changed for the new version. Its foundation is a black sheet-metal chassis that serves to support both the controller and its hard disk. The assembly occupies one to one-and-a-half expansion slots, according to the measurement scheme of hard disk card makers.

You can install a short expansion board in the expansion slot immediately to the left of the Onboard 30's narrow half-length slot, which the Maynard controller occupies. The thick, hard end of the disk either occupies the far end of a second slot or displaces the speaker when you install the On-



FACT FILE

Maynard Onboard 30

Maynard Electronics
460 E. Semoran Blvd.
Casselberry, FL 32707
(305) 331-6402
List Price: \$995

Requires: DOS 2.0 or later

In Short: A well-constructed 30-megabyte hard disk card that delivers modest performance.

CIRCLE 675 ON READER SERVICE CARD

GREAT!
You've got
four ATs,
three PS/2
Model 30s,
one Model 50,
two 60s,
an 80, and
three PC Clones.

How do you
back them
all up?!



With a
single portable
MaynStream™ Tape Backup. It protects the data
on all the personal computers in your office!

Beating The New Double Standard.

As a hard drive user, you know tape backup is indispensable, but protecting all of your PS/2s, ATs, PCs, or compatibles can present many problems. Not only are you faced with the cost of buying individual tape backup units for each computer, but many backup systems that rely on image mode technology prevent you from restoring data from one computer to another. With MaynStream, however, it's no problem at all. Just snap MaynStream onto any personal computer equipped with our PC controller or our new, specially-designed Micro Channel PS/2 adaptor. *One* MaynStream will back up all the systems in your office, and its lightning-quick, *file-by-file* technology makes it simple to restore data from one computer to another. And for all its versatility, it's remarkably easy to use.

The Backup Connection.



MaynStream has a networking feature designed to work with all popular LANs including Novell, 3COM, and IBM's PC Net*, and is Novell-approved. MaynStream will not only back up a network while the network is up and running, but will actually back up open files automatically once they're closed!

Hardware Everywhere.

With the introduction of the new PS/2, plus IBM's endorsement of the not-so-floppy micro disk, you may find your 5¼" systems stuck with something important to say to your 3½" systems (and vice versa) and no way to say it. Enter, MaynStream! One portable MaynStream transfers any amount of data between your computers, easily, and accurately, no matter what size drives you use, and whether you have a PS/2, AT, PC, or compatible, including the Compaq 386 and IBM 3270*.

MaynStream from Maynard Electronics. The common denominator for these uncommon times.

Available at the finest computer stores. Call today for the name of your nearest authorized dealer or more information.

MaynStream is also available for internal installation in the PS/2 Models 60 and 80.



Maynard Electronics

460 East Semoran Boulevard • Casselberry, Florida 32707 • (305) 331-6402

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CIRCLE 495 ON READER SERVICE CARD

■ HARD DISK CARDS

board 30 in slot 1 of a standard PC or XT. To facilitate moving the speaker, the vendor supplies a speaker extension wire and a small bracket.

For use with DOS 2.1, software installation requires only the standard DOS utilities for partitioning and formatting. Under DOS 3.1 or later, you use a special Maynard utility instead. Although the drive comes with low-level formatting already performed, another Maynard utility will reformat the drive with a user-selected sector interleave. The same utility also includes disk diagnostics and the ability to turn an on-screen drive activity indicator on and off (which is located on the lower-right-hand side of the card but can be repositioned).

The Onboard 30 documentation is clearly written and extensive, but not entirely relevant because it's designed to serve a wide line of products.

Well integrated and well built, the Onboard 30 offers a full DOS volume of hard disk storage, modest performance, and some unique installation options. For users with systems that can take advantage of the options, the new version of the Onboard 30 is a good choice.

■ ■ ■ ■ MOUNTAIN COMPUTER INC. **Mountain Computer DriveCard 50**

Since the introduction of its first DriveCards, Mountain Computer has unflinchingly pushed single-slot capacities higher. The current Mountain Computer DriveCard 50 (\$1,095) marks the top of today's single-drive capacities: 50 megabytes. As with previous DriveCards, all that storage comes in a well-built, tightly integrated product.

Instead of using a simple metal bracket as most hard disk cards do, the DriveCard 50 uses two well finished plastic brackets. One attaches to the card's retaining bracket and reinforces the strength of the proprietary controller card. The other bracket shrouds the electronics of the Fuji Electric 3½-inch hard disk. Screws in the bracket and the normal card edge connector secure the hard disk.

The DriveCard 50 nominally requires



The Mountain DriveCard 50 nominally requires two slots for installation, since part of the bracket around the controller card prevents using the adjacent half slot. The controller uses RLL technology to squeeze 50 megabytes onto a drive that would normally hold 35.

two slots for installation; part of the bracket around the controller card prevents using the adjacent half-slot. You can install the DriveCard in a single slot—but only in slot 1 of a PC or XT—by relocating the speaker mounting bracket.

The DriveCard 50 draws all its power requirement from the PC bus and does not need a direct connection to the host computer's power supply. Despite Mountain Computer's lowball claim of 9.8-watt power consumption, the hard disk itself draws more than 14 watts. The vendor understandably recommends upgrading the power supply when you use the DriveCard 50 in a 63.5-watt PC.

As with previous DriveCards, the hard disk controller of the DriveCard 50 is a proprietary Mountain product based on the Scientific Micro Systems RLL chip set. RLL ups the data transfer rate of the DriveCard to 7.5 MHz and squeezes 50 megabytes onto a drive that would normally hold 35.

Jumpers on the Mountain controller allow you to direct the card to function as the first or second hard disk in your system; this determines the drive letter assigned to it and whether it will boot your computer. (Only hard disk drive C: is allowed to boot

a PC.) The controller will also operate additional hard disk drives.

Besides an installation program, Mountain includes several helpful utilities with the DriveCard 50. One, ShipDisk, parks the hard disk heads to prevent damage during transportation and shipping, even though the Fuji drive securely locks its heads in place whenever you switch off the host system. Another utility does low-level formatting of the DriveCard, with user-selectable sector interleaves from 1 to 16. The vendor ships the DriveCard, however, as both low-level formatted and DOS for-



FACT FILE

Mountain Computer DriveCard 50

Mountain Computer Inc.
360 El Pueblo Rd.
Scots Valley, CA 95066
(408) 438-6650

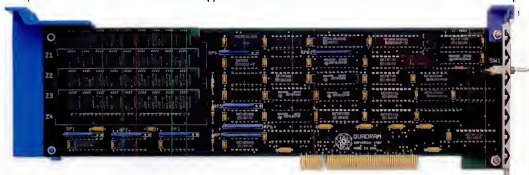
List Price: \$1,095

Requires: DOS 2.0 or later.

In Short: A big hard disk in a little package: 50 megabytes coupled with AT-like performance. Plugs into nearly any computer.

CIRCLE 67 ON READER SERVICE CARD

More than memory. Intelligence.



NOW SHIPPING

Building great memory into your PS/2™ Model 50 or 60 takes more than just stuffing a board. It takes intelligence.

You need a memory board that's smart enough to anticipate potential problems and solve them if they crop up. Problems like two boards fighting over the same address, or boards not meeting the squeaky-tight specs that IBM has set down for PS/2 enhancements.

With QuadMEG PS/Q you get a board that has not one but three IBM Micro Channel IDs—a primary and two back-ups—to avoid



Not one Micro Channel™ ID, but three—a primary and two back-ups. Avoids conflict with other boards that could cripple your system.



Switch between expanded and extended memory.

address conflicts.

Also, you need a board that's smart enough to save you steps in your everyday work. To start up each day without a hassle. Smart enough to switch easily between extended and expanded memory.

And smart enough to grow as you need more memory. From a family of PS/2 enhancements that keeps your computer open to change and growth.



Rigorous new Quadram Tolerance Test means QuadMEG PS/Q connections are positioned to within 0.001 in. Trouble-free operation and no misconnections.

Consider QuadMEG PS/Q. And then consider the alternatives. Make sure they don't try to give you the memory without the intelligence.

By the way, if you need parallel or serial ports, either

alone or with memory, check out Quadboard PS/Q and QuadPort PS/Q, which ship early this Fall.

See what we mean? Since you need more than great memory, get the intelligent PS/2 memory board, QuadMEG PS/Q, only at your Quadram dealer. For the name of a

dealer near you, contact Quadram at One Quad Way, Norcross, GA 30093. Or call 404/564-5566 to learn about our other PS/2 enhancements.

QuadMEG PS/Q
by QUADRAM

IBM EXPANDED
OS/2 EXTENDED
60286 PROTECTED

100% compatible

QuadPort PS/Q

QuadMEG PS/Q

Quadboard PS/Q

QuadMEG PS/Q

QuadMEG PS/Q

QuadMEG PS/Q

QuadMEG PS/Q

QuadMEG PS/Q

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QuadMEG PS/Q



Total IBM PS/2 BIOS support means QuadMEG PS/Q starts up automatically when you turn on your Model 50 or 60.

■ HARD DISK CARDS

matted for Version 3.1 or later.

Because the 50-megabyte capacity of this DriveCard exceeds the addressing ability of DOS, Mountain includes a driver for creating from one to ten extra DOS volumes, each addressable by its own drive letter.

The DriveCard 50 scores about midway between the performance specifications of the XT and the AT, with an average access time of about 61 milliseconds.

The instruction manual for the 20- and 30-megabyte models of the DriveCard is exemplary. The specific instructions for the DriveCard 50 amount to a one-page addenda. According to Mountain, an updated manual covering this model will be available soon.

In the documentation, Mountain lists the many tested systems the DriveCard supports, including IBM personal computers (except the PS/2 line), most Compaqs, and AT&T machines. Operating system support includes later versions of MS DOS, AT&T DOS, Xenix, and PC/IX, as well as Novell, 3Com, and IBM networks.

The wide range of compatibilities is one of the best recommendations for the DriveCard 50. Its quality design and construction make it an excellent choice for users who need large mass-storage capacity but don't have much space to spare.

■ ■ ■ ■ ■ PLUS DEVELOPMENT CORP.

Plus Development HardCard 20 and Plus Development HardCard 40

Plus Development Corp., creator of the \$795 HardCard 20 and the \$1,195 HardCard 40, developed the first hard-disk-on-a-card for PC compatibles. At .8 inch wide, the first HardCard was a masterpiece of miniaturization, able to pack 10 megabytes of additional storage into a single PC, XT, or Portable PC expansion slot. For a fledgling, this product was notable for its integration and refinement, and it put various copycats and clones to shame.

The elegantly compact packaging of the Plus Development HardCard is still evident in the HardCard 20 and HardCard



Plus Development's HardCard 20 (left) and HardCard 40 (right) are distinguished by their diminutive size and ease of installation. The HardCards take up only one full-length slot in any system, with no need to move speaker mounting brackets. They draw power through the 8-bit PC expansion bus, making it unnecessary to fuss with additional wiring.

40, despite the doubling and quadrupling of capacity. They're still the most diminutive add-in hard disks available. Along the way, performance has improved with capacity, and the latest models are faster and cheaper than the original. The drives are even compatible with the PS/2 Model 30.

The HardCard 20 installation is much like that of the original, managed entirely by code contained on the disk drive itself. The HardCard 40 software is similar but located on an auxiliary floppy disk.

The setup procedure is the same for both models, and the most inexperienced users can easily handle it. All that's required is answering a few on-screen queries and shifting disks as requested by the software.

Installing the hardware is as simple as it can get; you just slide the drive into a vacant slot. The HardCards take one full-length slot, no matter what the host system, and with no need to move speaker mounting brackets.

Nor is any additional wiring required, because both HardCards draw their minimal electrical needs (about 8 watts each) through the 8-bit PC expansion bus. (This narrow bus limits performance in a full 16-bit system such as the AT.) In most sys-

PC EDITOR'S CHOICE FACT FILE

Plus Development HardCard 20

Plus Development Corp.
1778 McCarthy Blvd.
Milpitas, CA 95035
(800) 826-8022 (product support)
(408) 434-6900
List Price: \$795

Requires: DOS 2.0 or later.

In Short: A diminutive, single-slot, high-performance 20-megabyte hard disk card with commendable tested average access time of 43 milliseconds. The system is compatible with the IBM PC, PC/AT, and PS/2 Model 30.

CIRCLE #79 ON READER SERVICE CARD

Plus Development HardCard 40

Plus Development Corp.
1778 McCarthy Blvd.
Milpitas, CA 95035
(800) 826-8022 (product support)
(408) 434-6900
List Price: \$1,195

Requires: DOS 3.0 or later.

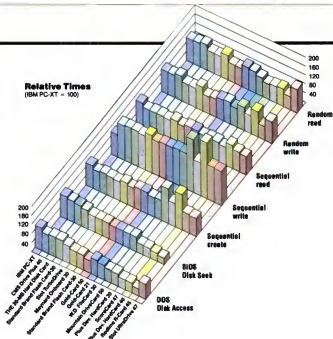
In Short: A single-slot, high-performance 40-megabyte hard disk card. Tested average access time is 40 milliseconds. Compatible with the IBM PC, AT, and PS/2 Model 30.

CIRCLE #82 ON READER SERVICE CARD



Benchmark Tests: Hard Disk Cards

The Rodime R-Card 45, with a 26.5-millisecond seek time and similarly impressive results on all of the PC Labs tests, was clearly the fastest drive in the group. With its 45-megabyte disk size and top-notch performance, it belied the hard disk card's second-class image. While the Plus Development HardCards had the next-best BIOS Disk Seek, DOS Disk Access, and random read timings, their performances in the other tests were, as in the last hard disk card roundup, less spectacular. The use of an SCSI interface in the controller of the Slot UltraDrive 47 made the results of our BIOS Disk Seek test meaningless. Pulling up the rear with performances similar to that of the original IBM PC-XT 10-megabyte drive were the CMS Drive Plus 40, the THE 20-MB Hard Disk Card, and the Standard Brand Flash Card-20—with other drives tested filling in the middle of the range.



Performance Times

(Times given in seconds except where noted)

	DOS Disk Access (milliseconds)	BIOS Disk Seek (milliseconds)	Sequential create	Sequential write	File Access Sequential read	Random write	Random read
IBM PC-XT with 10-Mbyte hard disk	114.2	95.3	11.5	11.9	11.7	30.2	23.0
CMS Drive Plus 40	92.8	89.6	10.0	18.5	9.9	30.4	23.8
THE 20-MB Hard Disk Card	101.1	83.7	10.8	18.9	10.2	33.1	25.2
Standard Brand Flash Card-20	98.0	79.8	10.3	18.7	10.2	26.0	20.5
Slot TurboDrive	85.4	67.5	9.9	18.2	9.7	26.0	19.8
Maynard Onboard 30	73.9	66.7	11.1	20.1	11.0	31.5	24.5
Standard Brand Flash Card-30	72.7	66.4	9.9	18.4	9.9	23.1	18.2
Gold-Card 50	62.5	52.6	11.3	18.9	11.1	24.6	18.2
Gold-Card 21	80.3	52.5	11.2	19.1	11.1	28.1	22.5
Western Digital FileCard 30	72.0	62.3	10.4	19.5	10.3	28.9	21.5
Mountain Computer DriveCard 50	63.6	81.7	10.6	19.6	10.5	25.8	18.8
Plus Development HardCard 20	60.6	42.9	18.5	28.4	10.3	31.4	15.8
ScoreCard 47	48.0	40.2	12.4	17.9	9.5	24.6	16.8
Plus Development HardCard 40	49.4	35.7	19.0	30.2	12.1	34.9	17.7
Rodime R-Card 45	35.5	26.5	10.3	16.8	10.3	19.4	13.4
Slot UltraDrive 47	75.6	N/A	9.9	18.5	9.7	30.3	23.8

N/A—Not applicable: with SCSI drives, the BIOS Disk Seek result is not reliable.

The DOS Disk Access benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

The File Access benchmark test measures the time it takes to sequentially create and write a 256K-byte data file using record lengths of 512 bytes and 4K bytes. The test program then performs a series of operations: a sequential read of the same file, a random write, and a random read.

■ HARD DISK CARDS

tems, either HardCard will function as the first or second hard disk; as the first, it can boot the host computer.

Despite the capacity difference, both the HardCard 20 and the HardCard 40 use two platters inside their integral disk drives. The whole assembly—drive and controller—is manufactured by Matsushita, parent of Panasonic (among other companies). Both HardCards use RLL data coding and have automatic head parking capabilities.

To cram more capacity on the HardCard 40, the manufacturer doubles the number of tracks used for data, up to a total of 1,224, shoehorned across a less than 1½-inch-wide swath of the 3½-inch disk.

The clever track-packing scheme butts head-on into the 1,024-track limit of most current PCs. Plus Development avoids difficulties by logically dividing the HardCard 40 hard disk so that it looks to its host computer as if it has half as many cylinders and twice as many heads.

The HardCard 40 proved superior both to its 20-megabyte sibling and the AT 40-millisecond drive specification, with a tested average access time of about 36 milliseconds. The HardCard 20 also proved commendably fast, turning in an average access time of about 43 milliseconds.

As an added feature, both drives include disk management software. The HardCard 40 also includes a query-driven partition program, which divides the full 42.26-megabyte capacity into one to four partitions.

The hallmarks of the HardCard line are compact size, low power needs, and superior workmanship and product integration. Although bigger, faster, and more capacious hard disk cards are available, none are better made than the HardCards.

■ ■ ■ ■ RODIME INC. **Rodime R-Card 45**

Ordinarily, little hard disks like Rodime's \$1,495 R-Card 45 have big average access times. They sacrifice speed to achieve compactness. But with the Rodime R-Card 45, a group of clever Scotsmen has broken through that dilemma and produced a 3½-inch hard disk with average



Rodime squeezed four platters into the small housing of its R-Card 45 to give the disk its high capacity. The card uses Rodime's own disk drive and a Western Digital controller and requires one-and-a-half slots. A heavy metal case protects its electronic components.

access times rivaling some of the better 5¼-inch disks, and with capacity to match—45.5 megabytes.

The R-Card 45 earns its capacity not through special tricks or even RLL encoding, but through the more conventional technique of squeezing more platters into the small housing. There are four platters, and seven of the eight disk surfaces are used (six for data and one for servo information for the high-speed voice coil head positioner). On the PC Labs benchmark tests, this Rodime mechanism proved its worth with an average access time of 26 milliseconds.

Mate one of those quick little critters with a Western Digital disk controller, package it in a sturdy black metal wrap-around shell, and you have the 45-megabyte R-Card 45. Incidentally, it's the only hard disk card examined here that uses a disk drive made by the disk card vendor.

The R-Card 45 is also one of the few hard disk cards that currently claims compatibility with the complete IBM line of PCs using the standard expansion bus: PCs, XTs, ATs, and even the PS/2 Model 30. It uses the 8-bit XT data path and consequently will transfer information at

about half the speed of the standard hard disk in AT-type systems.

Besides speed, large capacity, and compatibility, the R-Card 45 earns high marks for sturdiness. The heavy metal case protects the critical electronics, and the card does not bend or flex as many other disk cards do.

As with most hard disk cards that use extra platters, the card nominally requires

(continues)



FACT FILE

Rodime R-Card 45
Rodime Inc.
Peripheral Systems Div.
29525 Chagrin Blvd., #214
Pepper Pike, OH 44122
(216) 765-8414
List Price: \$1,495

Requires: DOS 2.1 or later.
In Short: The highest-performance hard disk card available that also yields high capacity in one and a half slots. Compatible with the PS/2 Model 30.

CIRCLE #71 ON READER SERVICE CARD

Once again,
Compaq
raises the standard
of performance
for personal computers.

This time
by a factor of two...



Introducing the two on earth



The new COMPAQ DESKPRO 386/20™

Last year, we introduced the COMPAQ DESKPRO 386™ the most advanced personal computer in the world. Now the world has two new benchmarks from the leader in high-performance personal computing. The new 20-MHz COMPAQ DESKPRO 386/20 and the 20-lb., 20-MHz COMPAQ PORTABLE 386 deliver system

performance that can rival minicomputers. Plus they introduce advanced capabilities, without obsoleting your investment in software, hardware and training.

Our new computers employ an industry-standard 20-MHz 80386 microprocessor and sophisticated 32-bit architecture.

But to make these two of the world's fastest PC's, we did more than just increase the clock speed.

For instance, both are built around a concurrent bus architecture. Two buses—one for memory and one for peripherals—eliminate information bottlenecks, allowing each component

It simply works better.

most powerful PC's and off.



and the new 20-MHz COMPAQ PORTABLE 386™

to run at its maximum speed. Together, they insure the highest system performance without sacrificing compatibility with industry-standard peripherals.

Both computers offer disk caching. Both offer the most memory and storage within their classes. Both let you run software being written to take ad-

vantage of 386 technology. And both run new MS-DOS®/BASIC Version 3.3 as published by Compaq. With it, our new portable and our new desktop can break the 32-megabyte limit on file sizes that handcuffs other PC's, allowing you to build files up to the size of your entire fixed disk drive.

And from now until December 31, 1987, both computers come with a free package of new Microsoft® Windows/386 Presentation Manager. It provides multitasking and switching capabilities with today's DOS applications to make you more productive. But that's just the beginning. To find out more, read on.

COMPAQ®

The question wasn't but how to get the

System Board with 20-MHz Cache Memory Controller

135-MB Tape Backup

Weitek Coprocessor Board

20-MHz 80386 processor

300-MB Fixed Disk Drive

16 MB of 32-bit RAM

The most powerful personal computer in the world

The COMPAQ DESKPRO 386/20 is an impressive 50% faster than 16-MHz 386-based personal computers. Even more impressive is the fact that it's up to 25% faster than other 20-MHz 386's. That's because the processor is just one small part of how the COMPAQ DESKPRO 386/20 outperforms every other PC

in the world today and even many minicomputers.

The big reason is the new COMPAQ Flexible Advanced Systems Architecture, which optimizes overall system throughput while maintaining full compatibility with industry-standard peripherals. It does this by combining an

advanced memory caching scheme with memory and peripheral buses that operate concurrently.

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how to get to 20 MHz, most out of 20 MHz.



erals operating at the industry-standard 8 MHz.

This flexible approach allows you to dramatically increase system throughput while preserving your investment in monitors, disk drives, and expansion boards. It can also accommodate today's and tomorrow's most advanced peripherals without constraining their performance.

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ing and scientific applications by a factor of six, giving the COMPAQ DESKPRO 386/20 the performance of a dedicated engineering workstation at a fraction of the cost.

Compaq also provides 130- and 300-Megabyte Fixed Disk Drives with some of the industry's fastest access times. And when used with disk caching software, they represent the highest-performance storage subsystems available.

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One full megabyte comes standard and is expandable to 16 megabytes without using an expansion slot. Plus, we included the COMPAQ Expanded Memory Manager. It supports the LIM standard so your software can break the 640-Kbyte barrier even before OS/2™ is released.

As tasks become more complex and users demand more advanced capabilities, Compaq responds by raising the standard of performance in personal computing.

COMPAQ
DESKPRO 386/20

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Pound for pound, it is the world's most powerful computer

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But no one expected the new COMPAQ PORTABLE 386 to run at 20 MHz. And no one even

dreamed that it would offer 100 megabytes of storage, disk caching, and much, much more.

Our newest 20-lb. portable computer goes far beyond an 80386 microprocessor with a handle. It's not just the most advanced portable in the world.

Pound for pound, it's the world's most powerful computer. Period.

Like the recent COMPAQ PORTABLE III™ which changed the shape of full-function portable computing, the COMPAQ PORTABLE 386 makes no compromises. It offers more speed, memory, storage and features than any other portable PC. It runs your current software up to 25% faster than 16-MHz 386 PC's. Beyond that, its performance in calculation-intensive

It simply works better.

to introduce a 386 portable PC. expected all this.



100-MB Fixed Disk Drive



40-MB Tape Backup



20-MHz 80386 processor



10 MB of 32-bit RAM



2400-baud Hayes-compatible modem



5 1/4-inch 1.2-MB Diskette Drive

applications is increased even more when you add an optional 20-MHz 80387 coprocessor.

Memory? Get one megabyte of 32-bit, high-speed RAM standard or go as high as 10 MB internally. And like all of the COMPAQ 386-based PC's, it features the COMPAQ Expanded Memory Manager.

With our high-performance 100-megabyte internal fixed disk drive, you can actually fit 500 lbs. of data-filled pages into a 20-lb. PC,

unsurpassed storage for a portable. If that's too much for you, we also offer a 40-megabyte model.

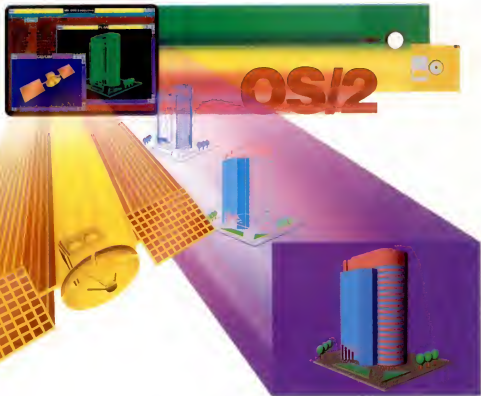
We've become famous for building desktop computer capabilities into our portables without leaving anything out. The COMPAQ PORTABLE 386 is more proof. It has a high-resolution, 640 x 400, 10-inch plasma display; a full-size, portable enhanced keyboard; two industry-standard expansion slots in a lightweight, optional plug-on unit; a choice

between an optional 2400- or 1200-baud Hayes-compatible modem; a full-size 5 1/4-inch 1.2-MB diskette drive; even an optional 40-MB tape backup.

These features, combined with the ultimate in portable performance, make the COMPAQ PORTABLE 386 the *biggest PC this small.*

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PORTABLE 386™

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graphics if you wish. Run OS/2 when it's available. And now 3 1/2-inch drives are even an option for our desktops.

We optimize the most advanced technology while maintaining compatibility with the past, present and future. This makes COMPAQ PC's a wise decision for serious business users. Because at Compaq, we don't burn bridges, we build them.

See the COMPAQ DESKPRO 386/20 and COMPAQ PORTABLE 386 at an Authorized COMPAQ Computer Dealer. And from now through December 31, 1987, get Microsoft Windows/386 Presentation Manager free when you buy a 386-based COMPAQ computer. For more information, call 1-800-231-0900 Operator 40. In Canada, call 416-733-7876, Operator 40.

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■ HARD DISK CARDS

what most vendors describe as one-and-a-half slots (the conservative R-Card documentation lists the requirement as "up to two" slots). The disk drive itself hangs off to the left of the bulk of the card. A short card will fit next to the controller section (on the left). You can cram the R-Card 45 into slot 1 of a PC or XT with the host's speaker bracket moved. It fits into the middle slot of the PS/2 Model 30, leaving space for a half-card and another full-length expansion card.

A disadvantage of the R-Card 45's case is that you're instructed to remove one of the cover panels (actually, the whole back side) in order to set a pair of jumpers when installing the system. The documentation never mentions that the R-Card 45 is factory-configured to work as the first hard disk in the host computer. Changing the jumpers allows you to use it as the second drive in a computer already equipped with a hard disk.

The documentation is one of the weakest aspects of the R-Card 45—slickly printed, but inconsistent. Though clear at times, it lapses into too many assumptions and unclear examples—such as offering the instruction to "ensure +5V and +12V are present" as a troubleshooting hint. The average PC user, with neither test equipment nor the knowledge of how to test for these voltages, is left completely unassisted.

A software disk comes with the hard disk card. One program, used during installation, includes diagnostics, a low-level-formatting utility, and a partitioning facility used in lieu of DOS FDISK. An optional driver allows you to divide the R-Card 45 into up to eight separate DOS partitions, each with its own drive letter.

Running at its fast pace, the R-Card 45 works up quite an appetite, typically consuming about 17 watts, according to its documentation. The drive draws power directly from the host computer's power supply, using a wye cable supplied by Rodime.

The R-Card 45 is a top-performing hard disk card that's bothered by a few developmental problems. Beginners may need some help in getting it running, but more experienced users who want the utmost in hard disk performance will make the R-Card 45 their first choice.

■ ■ ■ ■ ■ SILICON VALLEY COMPUTER

Gold-Card 21 and Gold-Card 50

In the quest for a catchy name, Silicon Valley Computer has come up with two products that sound as if they're intended for making premium purchases on credit: the \$499 Gold-Card 21 and the \$799 Gold-Card 50. The Gold-Cards are neither charge cards nor premium products but a simple mating of industry-standard disk and controller components.

Wipe away the nomenclature and marketing, and these two models in the Gold-Card line prove to be well-made and competent products capable of adding hard disk storage to PCs, XTs, ATs, and PS/2 Model 30s. The components hail from respected manufacturers, and the packaging is the same standard, straightforward fare available from the majority of hard disk card suppliers.

Both Gold-Cards feature a hard disk controller manufactured by Scientific Micro Systems. The drives themselves are 3½-inch Fuji Electric products, each of which features automatic head parking at power-down. The 21-megabyte unit uses

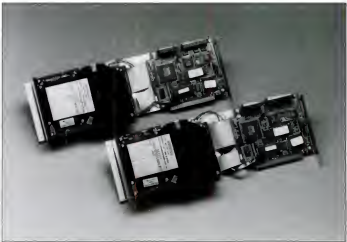
standard MFM (modified frequency modulation) encoding. To increase capacity, the 50-megabyte drive operates with RLL encoding.

The mounting system is a basic bent-aluminum sheet that merely serves as a platform to which the major components can be attached. The implementation of the mounting scheme is the biggest weakness of the Gold-Card system. Since the card-retaining bracket is part of the disk controller, the bracket is subject to more stress than it was designed to bear.

What's worse, the controller attaches to the flat aluminum subchassis by short insulating spacers, which push the chassis more than a quarter-inch back from the normal plane of expansion board substrates. That means the board substantially trespasses into the adjacent slot, precluding the use of wider expansion cards in the full slot to the left of the card.

The hard disk itself hangs off the subchassis on the right, leaving half a slot for a short expansion board on that side of the Gold-Card. In some cramped host computer systems, this mounting system may limit expansion.

Fuji hard disks are hardly the most frugal with electricity. Both the 21- and the



Silicon Valley Computer's Gold-Card 21 (left) and Gold-Card 50 (right) use the industry-standard 3½-inch Fuji Electric drives and Scientific Micro Systems controllers. Although both products are competent performers, a faulty mounting scheme forces the boards into the adjacent slot, precluding the use of wider cards in the full slot to the left.

■ HARD DISK CARDS

50-megabyte unit consume about 13.5 watts, drawn through the PC bus, although the manufacturer claims that both cards use only 8 watts of electricity when running.

The band-stepper head actuator of these drives puts them in the medium performance category. Both drives achieved a tested average access time of about 62 milliseconds, comfortably within the 65-millisecond rating given by the supplier.

Hardware installation of both Gold-Cards requires no more than sliding the cards in place. The Gold-Card 21 is formatted under DOS 2.1 and requires only copying system files to be ready for use in host computers under that operating system. Operating under DOS 3.0 or later necessitates partitioning and formatting the disk.

The Gold-Card 50 is preformatted for use with PC DOS 3.1 or 3.2. Its on-board BIOS is not compatible with MS-DOS.

Although low-level formatting is not required to get either Gold-Card running, the procedure is available through controller card firmware using DEBUG. The procedure allows you to set whatever sector

interleave you want, and also to partition the Gold-Card 50 to split the total drive capacity into DOS-size volumes.

Both Gold-Cards come factory-configured to operate as drive C:. Adding two jumpers to the controller allows you to use them in computers that already have a hard disk installed.

Inexperienced users are more likely to be perplexed than aided by the Gold-Card instruction manuals. The somewhat shaky and at times misleading support makes the Gold-Cards more appropriate for experienced PC users than for novices.

While the quality components of the Gold-Cards should guarantee reliable operation, you should carefully read the warranty policy that you negotiate in writing on your invoice. While the documentation offers a 2-year warranty, it also mentions an 8 percent surcharge for each year beyond the initial 90-day period. The Silicon Valley Computer warranty policy is unusual for such ordinary products.

■ ■ ■ ■ ■ STANDARD BRAND PRODUCTS

Standard Brand Flash Card-20 and Standard Brand Flash Card-30

Honest, refreshing, and uncomplicated are apt descriptions of Standard Brand Products' \$369 Flash Card-20 and \$419 Flash Card-30. Other manufacturers go to great lengths to obscure the origins of the components that make up their systems, but Standard Brand Products hides nothing. Indeed, it has nothing to be ashamed of; the Flash Cards are made from quality components from highly regarded manufacturers.

Both the Flash Card-20 and Flash Card-30 are based on the same model hard disk, a Miniscribe 8425, with a nominal capacity of 20 megabytes. The Flash Card-30 stretches that storage to 30 megabytes using RLL data encoding implemented with a Western Digital WD1002-27X controller. The Flash Card-20 uses normal MFM (modified frequency modulation) data coding and a Western Digital WD1002-WX1 controller. Of course, the drive choice means that the Flash Cards lack head parking at power-down.



FACT FILE

Standard Brand Flash Card-20

Standard Brand Products
CompuAdd
12303-G Technology Blvd.
Austin, TX 78727
(800) 531-5475 (outside TX)
(512) 250-5541
List Price: \$369

Requires: DOS 2.0 or later. Recommended: 256K RAM on motherboard for IBM PC; power supply upgrade from 130 to 150 watts if installed with internal modem and 640K RAM on IBM PC. Not recommended for Compaq computers made before 1985.

In Short: An easy-to-use 20-megabyte hard disk card with slower performance (about 80-millisecond average access time), it requires one and a half slots and offers good value.

CIRCLE 666 ON READER SERVICE CARD

Standard Brand Flash Card-30

Standard Brand Products
CompuAdd
12303-G Technology Blvd.
Austin, TX 78727
(800) 531-5475 (outside Tex.)
(512) 250-5541
List Price: \$419

Requires: DOS 2.0 or later. Recommended: 256K RAM on motherboard for IBM PC; power supply upgrade from 130 to 150 watts if installed with internal modem and 640K RAM on IBM PC. Not recommended for Compaq computers made before 1985.

In Short: An elegantly simple RLL-based 30-megabyte hard disk card that requires one and a half slots, gives midrange performance, and offers good value.

CIRCLE 667 ON READER SERVICE CARD



FACT FILE

Gold-Card 21

Silicon Valley Computer
140 Archer St.
San Jose, CA 95112
(408) 288-8837
List Price: \$499

Requires: DOS 2.1 or later.

In Short: A preformatted 21-megabyte hard disk card that requires one and a half slots and delivers midrange performance. Compatible with the PS/2 Model 30.

CIRCLE 670 ON READER SERVICE CARD

Gold-Card 50

Silicon Valley Computer
140 Archer St.
San Jose, CA 95112
(408) 288-8837
List Price: \$799

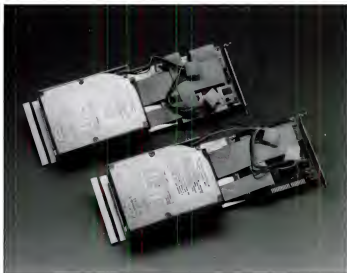
Requires: PC DOS 3.1 or 3.2 (not MS-DOS).

In Short: A high-capacity, near-50-megabyte RLL hard disk card that requires one and a half slots and delivers midrange performance. Compatible with the PS/2 Model 30.

CIRCLE 666 ON READER SERVICE CARD

The models are similar-looking: both have Standard Brand's sturdy aluminum subchassis. A one-piece stamping, this chassis fills a full-length PC expansion slot; one end of the chassis is bent over to serve as a retaining bracket, and the other end acts as a card edge guide. At the end that's farther from the PC's rear panel, two folded wings enclose a standard 3½-inch form factor hard disk.

The width of the chassis totals about 1.8 inches. The 6-inch-long part of the chassis nearest the retaining bracket is no wider than a standard XT slot, so the Flash Cards fit the industry definition of one and a half slots wide.



Standard Brand's Flash Card-20 (left) and Flash Card-30 (right) are based on the Miniscribe 8425 hard disk and different Western Digital controllers. Two folded wings on the sturdy 1.8-inch-wide aluminum subchassis enclose the 3 1/2-inch form factor hard disk. The controllers are connected to the drive via exposed ribbon cabling.

Both models of disk controller used on the Flash Cards are 5 inches long and screw directly into the subchassis. Exposed ribbon cabling, neatly folded, connects controller to drive. The disk drive it-

■ The Flash Cards aren't the fastest or the most compact cards, but they give you all you need for a good dose of mass storage without bother.

self derives power (about 10 watts) directly from the host computer's power supply through an included wye cable.

Incidentally, the Flash Card-30 performed somewhat better on the PC Labs average access time test than did the Flash

Card-20. (The method of data encoding should not affect the results of this test.) The Flash Card-20 barely squeaked under the 80-millisecond XT hard disk specification. The Flash Card-30 achieved a time of about 66 milliseconds—acceptable but hardly exciting.

Both drives are shipped preformatted for DOS 3.1 or later versions. An automatic installation program on the Flash Card disk copies system files from your boot disk to prepare the units to boot your system. Each system includes a disk that holds a low-level-formatting utility, a head-parking program, and a boot program that enables you to use the Flash Cards with early-model PCs that have 64K-byte system boards.

Complete instructions detail both manual and nonstandard installations. In fact, the documentation is exemplary in its clarity and content.

Standard Brand Products also packages Westlake Data's *PC-Fullbak*, a menu-driven hard disk file backup and restoration system, with each Flash Card.

The Flash Cards aren't the fastest, the

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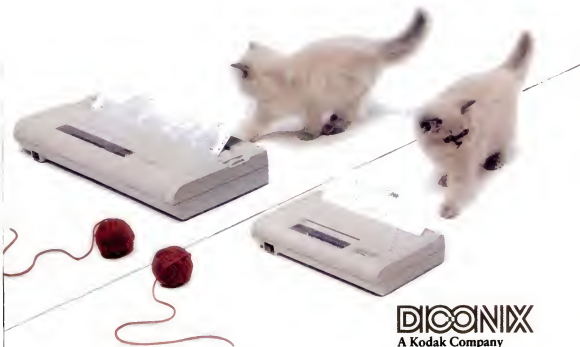
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■ HARD DISK CARDS

most capacious, or the most compact hard disk cards. But they give you all you need for a good dose of mass storage without hype or bother. The Flash Card-20 or the Flash Card-30 can be a hardworking, no-nonsense addition to your computer.

■ ■ ■ SYSTEMS PERIPHERALS CONSULTANTS

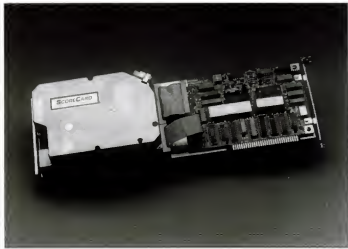
ScoreCard 47

Although it looks and works like any other hard disk card, the ScoreCard 47 (\$1,295, from Systems Peripherals Consultants) is unique in its choice of components. It uses a Fujitsu hard disk and a Paterson Lab hard disk controller.

This pairing pushes the ScoreCard into the upper reaches of hard disk card speed and capacity. At about 40 milliseconds, it matches the AT spec for hard disk average access time and does out 42 megabytes of storage for your data. And it incorporates several extra speed-enhancing features (the performance of which, alas, doesn't show up in the PC Labs benchmark tests).

The 3½-inch Fujitsu drive is remarkable for containing four platters, all of which store data and are accessed by a relatively quick band-stepper head positioner.

The Paterson Lab controller incorporates several techniques to speed up data transfers, including on-board buffering and the ability to support true one-to-one sector interleaving. Its documentation claims to allow data transfers at the full rat-



The pairing of a 3½-inch Fujitsu hard disk and a Paterson Lab controller pushes the ScoreCard 47 into the upper reaches of hard disk card speed (40 milliseconds) and capacity (42 megabytes). The drive contains 4 platters and occupies one and a half slots.

ed 5 MHz of the standard ST506 interface using MFM (modified frequency modulation), but if that's true, the rate applies only to short data bursts. Although actual throughput of large blocks using DOS is at a fraction of that figure (about 80 kilobytes per second), the ScoreCard actually moved bytes twice as fast as a nonbuffered disk when an inadequate number of the DOS disk buffers were assigned.

Physically, the ScoreCard is a rudimentary creation, a flat-panel subchassis onto which both controller and hard disk are screwed. It occupies one and a half slots, with the hard disk hanging off to the right to allow space for a short board in the adjacent slot. The subchassis impinges on about a quarter inch of the adjacent slot on the left as well.

The Fujitsu drive derives its power requirements directly from the host computer's power supply.

System setup is facilitated by the firmware of the Paterson hard disk controller. If the drive has not been initialized when the system first boots, it queries you to determine whether you'd like to set it up. Say yes, and it dumps you into a low-level-formatting routine.

The ScoreCard comes without documentation, except for that supplied by the manufacturer of the controller. According to the company, the installation process for hard disk cards is so universally well understood that instruction manuals are not

■ If you need the greatest possible capacity for your system without using up a drive bay, the ScoreCard 47 is a good choice.

necessary. Furthermore, the company offers unlimited telephone support to those who need help to get their systems running.

One problem you're likely to encounter is in formatting. To format the drive, you must manually enter the number of heads and cylinders, along with similar information when prompted. If you don't know



FACT FILE

ScoreCard 47
Systems Peripherals Consultants
9747 Business Park Ave.
San Diego, CA 92131
(800) 345-0824 (outside Calif.)
(619) 693-8611
List Price: \$1,295

Requires: DOS 2.0 or later.
In Short: A high-capacity, 47-megabyte hard disk card with a high-data-transfer-rate controller. Telephone support makes up for its lack of documentation.

CIRCLE 100 ON READER SERVICE CARD

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External Unit	\$399

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All AT Drives include Data Cable, Slide Rails and Documentation.	

CIRCLE 236 ON READER SERVICE CARD

Qubie' 286-10 Mini "AT"

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- 640K RAM On Motherboard
- Socket For 80287 Math Coprocessor
- Floppy/Hard Drive Controller
- 1.2MB Floppy Disk Drive
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- Lockable Case
- "AT" Style Enhanced Keyboard
- 8 Expansion Slots
- Reset Button
- One Year Warranty

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Technical Support
(805) 482-9829
Hours: M - F 9am - 5pm PT/ Sat 9am - 11am



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■ HARD DISK CARDS

how the hard disk is configured, you're in for a lengthy trial-and-error session.

The Paterson formatting firmware also allows you to select the sector interleave. A floppy disk of other Paterson programs for disk and controller diagnostics, as well as a controller manual in a plain ASCII file, also accompanies the ScoreCard.

For capacity the ScoreCard ties with the Gold-Card 50, and beats it in performance. The system falls short of the industry leaders only in attention to detail and documentation. If you need the greatest possible capacity for your system without using up a drive bay, the ScoreCard is a good choice.

■ ■ ■ ■
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EDWARDS COMPUTER
PRODUCTS LTD.**

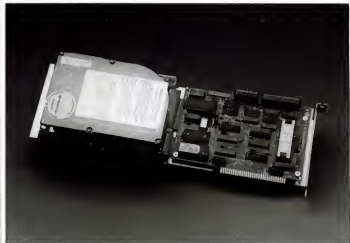
THE 20-MB Hard Disk Card

If any product was a candidate to be the ultimate generic hard disk card, THE 20-MB Hard Disk Card (\$499.95), from Thompson, Harriman and Edwards (THE) Computer Products, sounds like the one. The card's brand and product names, white box packaging, straightforward these-are-the-components-we-put-together approach attest to its generic nature. Although the 20-MB Hard Disk Card is indeed a workable product, its design development phase was apparently shortened in favor of marketing a cheap product quickly.

Nothing is inherently wrong with the product. The assembled components individually rate as sound choices. The hard disk drive is a 3½-inch 20-megabyte Miniscribe 8425; the controller, a Microtek Boardwalk HDC-1000.

Design weaknesses appear in the drive-mounting subchassis. Made from a single folded piece of aluminum that stretches from the card guide to include the retaining bracket, the subchassis extends more than a quarter inch to the left of the slot in which the assembly is installed. The hard disk leans out to the right. As a result, the height of any expansion boards installed in the slot to the left is limited, and only a short card will fit to the right.

Thompson, Harriman and Edwards



The THE 20-MB Hard Disk Card uses the 3½-inch Miniscribe 8425 hard disk drive and a Microtek Boardwalk HDC-1000 controller. A poorly designed drive-mounting subchassis limits the height of expansion boards installed to the left of the card and permits only a short card to the right.

supplies only the original manufacturers' technical manuals for the drive and the controller. That would be laudable were not such documentation written for engineers rather than mere mortals. End-user instructions include a two-page sheet that explains little and omits much.

For instance, the instructions note that if the ROM-resident automatic low-level-formatting routine (which is not identified as such) fails, you should retry DEBUG. But no instructions tell you to try DEBUG in the first place. If the initialization does complete correctly, normal DOS hard disk setup (with FDISK and FORMAT) consummates the installation. If you have some computer hardware savvy, you should be able to fumble through the entire installation process without a problem, but neophytes would be well advised not to attempt it alone.

On the positive side, the Miniscribe drive is more frugal with power than the more-popular Fuji Electric units, requiring only a tad more than 10 watts. (The electricity consumption of the controller card tacks on about another 5 watts to that figure.) The 20-MB Hard Disk Card system extracts the current it needs directly through the PC bus.

On the negative side, the Miniscribe trades off performance, turning in a tested average access time of 84 milliseconds—about 30 percent slower than the Fuji. The Miniscribe also lacks the ability to park its read/write heads automatically at power-down, which may increase chances of a head crash.

As expected with a generally generic system, the 20-MB Hard Disk Card offers very little beyond the essentials. You don't pay for what you don't need. But let the



FACT FILE

THE 20-MB Hard Disk Card
Thompson, Harriman and Edwards
Computer Products Ltd.
319 W. Ontario St.
Chicago, IL 60610
(312) 642-9626
List Price: \$499.95
Requires: DOS 2.1 or later.

In Short: A genuine generic hard disk card with 20-megabyte capacity, made from well-known components. Lacks refinement but makes up for it in value.

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Boca Raton, Florida 33467
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Paris, France; and London, England.

■ HARD DISK CARDS

buyer beware: the 20 MB Hard Disk Card slight guidance, performance, and security along with the frills.

WESTERN DIGITAL CORP.

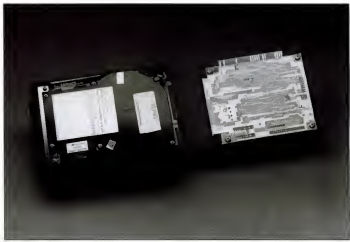
Western Digital FileCard 30

The first effort of Western Digital Corp. (maker of the \$699 FileCard 30 as well as hard disk controllers and integrated circuits) in marketing a hard disk card was a 10-megabyte drive noted for its low power consumption and slow performance. The Western Digital FileCard 30 eliminates those distinctions while pushing disk capacity up threefold.

At 12 watts, the electrical needs of the FileCard 30 are about the same as those of many similar products. Its 65-millisecond average access time is close to the mainstream mark.

That makes the FileCard 30 a yeoman product, capable of handling everyday hard work while imposing few penalties. Yet little distinguishes it from other hard disk cards of similar capacity, save for its disk management software.

The FileCard 30 is a 3½-inch hard disk mated with a 5-inch-long controller by a black, wrinkle-finished metal bracket. It requires one and a half expansion slots, swallowing one full-length slot while allowing you to mount a short card in the adjacent expansion connector to its left. Matching plastic covers surround the electrical components and enhance the File-



A wrinkle-finished metal bracket joins the Western Digital FileCard 30's 3½-inch hard disk to its 5-inch-long controller. The card requires one and a half slots and has two sets of jumpers on the controller that allow you to install it as drive C: or drive D:.

Card 30's rugged appearance.

Both the controller and the hard disk proper draw the power they require from the host computer's expansion bus.

Based on a 20-megabyte Fuji Electric hard disk, the FileCard 30 achieves its capacity (nominally 32 megabytes) through the use of RLL data encoding. The RLL controller is, as expected, a Western Digital unit; like all 2.7 RLL controllers, it ups the data transfer rate to 7.5 MHz. The same drive with an MFM (modified frequency modulation) controller (5-MHz transfer rate) is available as the FileCard 20.

The Fuji drive securely locks its head actuator in place automatically at power-down. Western Digital also includes a head-parking program with the system, so you can be doubly sure of your data's safety when you move the FileCard 30. The sturdy drive is rated to withstand 50 g's when dormant, 7 when operating.

Two sets of jumpers on the controller allow a limited degree of customization. You can install the FileCard 30 as either drive C: or drive D:. It's compatible with both XT and AT systems, selectable by jumper. The factory defaults aim the product at ATs, although the controller uses an 8-bit XT-style host interface.

All the necessary software for automatically installing the FileCard 30, as well as some bonus software, is delivered on the hard disk itself. To avoid the requirement for a software license, however, Western Digital does not include DOS files or even

■ All the necessary software for automatically installing the Western Digital FileCard 30, as well as some bonus software, is delivered on the hard disk itself.

a standard DOS format on the disk. Installing the card necessitates copying the data onto floppy disks as a backup, then formatting the FileCard 30. In a typical installation, the process takes about 12 minutes and requires you only to shuffle disks and



FACT FILE

Western Digital FileCard 30

Western Digital Corp.

2445 McCabe Way

Irvine, CA 92714

(714) 474-2033

List Price: \$699

Requires: DOS 2.0 or later.

In Short: A hard disk card that adds a full 30 megabytes of moderate-performance mass storage to any PC or PS 2 Model 30 system, in one and a half slots.

CIRCLE 864 ON READER SERVICE CARD

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- Also...**Pin-feed 1040s** included
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"TurboTax takes the prize for most forms"—
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■ HARD DISK CARDS



EDITOR'S CHOICE

- Plus Development HardCard 20
- Plus Development HardCard 40

A year of development has changed the hard disk card market but altered our choices little. Overall, all the products are better, both in conception and execution. The competition is keener than ever, the differences among the hard disks cards becoming almost minuscule.

Nevertheless, compared with the Plus Development HardCard series, all the others are still playing follow the leader. Both the HardCard 20 and the HardCard 40 rate as the best-integrated, the most developed, and possibly the best overall products.

When cost is paramount and you have an extra half-slot of space, Standard Brand Products' Flash Cards pull into the lead, ranking as the best buys with their straightforward honesty supplemented by clear and complete documentation.

For top performance, your best choice is the Rodime R-Card 45 a speedy little drive without peer.

press keys in response to prompts. Full manual-installation instructions are included in the clearly written accompanying documentation.

The FileCard 30 software bonus includes X-Tree, a menu-driven disk management system, and SpeedRead, a disk caching program that can improve the performance of the FileCard 30 on some disk-intensive chores. You can also configure SpeedRead to cache disk write as well as read operations.

Although the FileCard 30 is only an average performer, its construction quality is excellent and its level of integration is above average. If your needs are modest, the FileCard 30 will fill them ably.

Winn L. Rosch is a contributing editor of PC Magazine.

TimeWand® - Organizing Information



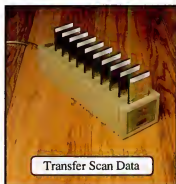
Filing problems?



Scan File



Scan ID Card



Transfer Scan Data



Edit Scan Data

Document Control Report File Room #5 September 4, 1987			
Code	Description	Employee	Date
004048	Jones Account	Pennie Bates	8/31/87
005104	Swann Account	Pauline Towson	8/31/87
006145	Smith Reference	Pauline Towson	8/31/87
006168	Charles Account	Pauline Towson	8/31/87
006167	Baker File	Matthew Webster	9/01/87
004373	1987 Research Budget	Matthew Webster	9/01/87
006176	Knowledge Report	Matthew Webster	9/02/87
006178	Advertising Plan	Bobbi Mich	8/02/87
006348	Laboratory Results	Bobbi Mich	8/02/87
006191	Meeting Notes	Bobbi Mich	8/02/87
005182	Garth Correspondence	Pennie Bates	9/02/87
005183	July Computer Sales	Pennie Bates	8/02/87
006184	Commerce Study	Pennie Bates	8/02/87
005185	Tollan Audit	Matthew Webster	8/03/87
006186	Product Development	Matthew Webster	8/03/87
006187			8/03/87
006188			8/03/87

Develop Data Reports

Applications for the TimeWand - Document Control

Ever wonder who has that important file on the Jones account? There is no record of who took it from the file room and no one remembers who had it last. You spend your valuable time and patience tracking it down, but when you finally locate the file, it may be too late for timely use.

Make it easy on yourself by tracking documents with the TimeWand. By simply scanning the bar code on the Jones file and your employee ID number (or department name), the TimeWand records who has the file *and* the time it was taken.

The TimeWand is simple to operate, yet provides the data necessary to create detailed reports. Generate reports by incorporating data collected with the TimeWand into your data base. The reports allow you to quickly find who has those important files, check a file's current activity, identify which items are 'slow movers', or show the amount of traffic the file room handles each day.

No manual data entry or deciphering of your co-worker's handwritten notes is required. All TimeWand entries are made by scanning bar codes! It's fast, easy, and, most importantly, organized.

TimeWand. It helps you keep up with the Joneses.

TimeWand (2K version) - \$198
Single Recharger and Cable - \$149
TimeWand Manager Software (Macintosh) - \$489
TimeWand Communication Software (IBM) - \$299



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The Big Ban



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At the top, the new WYSEpc 386 has one of the highest benchmark ratings yet for a personal computer. Our unique design achieves exceptional memory speed as well as processing speed for zero wait state performance on multiple operating systems. Such as MS-DOS®, OS/2®, and Xenix®. For CAD/CAE, heavy duty spreadsheets, or multi-user applications, it delivers power to satisfy the insatiable.

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Introducing SystemWyse.™ Our PCs form the core of a comprehensive system for creating solutions. They link effortlessly with our terminals, monitors, and expansion modules in solutions of exceptional quality and value. And SystemWyse is backed by the company that makes more terminals than anyone but IBM.

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The Buffalo® SX can actually multiply the effectiveness of laser printers, dot matrix and daisy wheel printers, modems, and plotters. Anyone can send work to any printer—even when it's busy—and go back to work immediately. So it can save you thousands of dollars on extra printers you don't buy.

All the right connections

The Buffalo SX is an intelligent buffer, switcher and interface converter all in one. It allows several PC users to select any output device connected to the network.

There are ten ports—five parallel and five serial. Five can handle either input or output. So you have lots of options. Seven PCs sharing three peripherals. Two PCs sharing eight peripherals. Or any combination between.

But that's only the beginning. You can link more SXs together to share a set of peripherals with any number of PCs (of course, when you get up into the dozens, you might need another laser).

Power windows & automatic transmission

To set up the SX, just plug it in and define the ports using the switches and software provided. Concise documentation tells you how. If you have a question, call our toll-free support line.

When someone's ready to print, they simply use the handy little menu that pops up on screen with the names you've chosen. Call your printers Martha, Chatterbox, Relic, whatever.

The SX does the rest. It handles interface conversions, making parallel and serial machines

work together. Yes, it even lets IBM® and compatible PCs share a laser with no fiddling. And PCs can exchange files with communications software.

Best of all, it stores print jobs in its large buffer and feeds data to the printers automatically. So people can use their computers within seconds. ("Large" means a standard 256K memory, expandable to one full megabyte.)

Free software bonus

Order now and receive \$100 worth of productivity tools free:

- HyperKey™ Keyboard Enhancer—increases speed and accuracy dramatically. Instant on-off for repeat keys!
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All you stand to lose are long coffee breaks

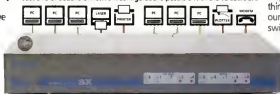
If you've tried a printer buffer, you know how limited most are. The SX is different. It's the slickest productivity booster this side of a \$10,000 LAN. It's so dependable, it comes with a full one-year warranty. Plus this money-back guarantee:

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CIRCLE 32 ON READER SERVICE CARD

You've just run out of excuses for not buying a new fixed-disk hard drive. Price is no longer an obstacle. Like hard disk cards (the other low-cost hard-disk option, reviewed by Winn L. Rosch in the accompanying article), fixed-disk hard drives, matching the standards for the drives installed in IBM PC-XTs and PC ATs, are now inexpensive—if you know where to find them.

A 20-megabyte drive for your XT can cost only \$299 to \$335. For a 30-megabyte AT-class drive, all you need to invest is \$485 to \$599. And you won't have to pay sales tax.

You'll find bargain hard drives like these not in your local computer store but in advertisements for mail-order companies like the five we look at here: 47th Street Computer, Lifetime Memory Products, PC Connection, PC Designs, and Priority 1 Electronics.

"I'm no fool," you shout. "I'm not sending my paycheck to some post office box! How do I know I'll ever get what I pay for?"

Being cautious is always wise, but you can put many of your fears to rest. The PC mail-order industry does an enormous amount of business, and it's as safe as any other enterprise. Industry watchers estimate that \$2.1 billion worth of PCs, peripherals, and software will move

THE NO-SWEAT WAY TO PUMP UP YOUR PC: MAIL-ORDER HARD DISKS



Low cost? Yes, the best prices ever for hard disk drives. Low risk? If you do your homework first. To help you be a better-informed consumer—and a better-equipped PC user—we tested the best-selling 20- and 30-megabyte mail-order hard disks and reviewed the five companies that sell them.

through the mails this year. The vast majority of the people generating all that cash won't have any problems.

Buying a fixed disk from a mail-order company is fast and convenient as well as cost-efficient. However, it does require some preparation on your part. As when buying any other kind of costly consumer goods, you'll want to be as well informed and protected as you can be.

When you buy a mail-order package, you're dealing with two separate primary issues: the product's performance and the mail-order company's performance. You'll want to know as much as possible about both the product you're thinking of purchasing and the company that sells it before you decide to buy.

You must analyze your needs also. You'll have to decide exactly what you want in the package you buy—in terms of the products it includes, the warranty and return policy, the instruction manuals, the company's technical support, its shipping and delivery practices, and, of course, the base price and all additional charges.

You should think in terms of the entire package, rather than in terms of the particular product's brand name, which can make the difference between you being a satisfied customer and having a bad experience buying by mail order.

MAIL-ORDER HARD DISKS

SEAGATE DRIVES The fixed disks available from mail-order companies are typically limited to certain models from a few manufacturers, dominated by Seagate. Judging from the companies reviewed here, the 20-megabyte XT-speed (80-millisecond or higher seek rate) fixed drives sold by mail order are predominantly Seagate ST225 drives with either Western Digital AWC1 or WD1002A-WX1 controllers or Everex EV391 controllers. The 30-megabyte AT-speed (40-millisecond or lower seek rate) fixed drives are predominantly Seagate ST4038 drives.

To help you through the process of choosing and ordering a hard drive from a mail-order company, we asked the five listed companies to send us their hard-drive packages for testing and evaluation. We chose these companies because they're among the biggest in the business. Here we review these basic packages and report the results of PC Labs benchmark tests.

All the 20- or 30-megabyte-drive packages from these five mail-order companies use the same Seagate drives, as described above. While there are more than a half-dozen major hard disk makers, Seagate produces considerably more drives than anyone else today, and—in the eyes of mail-order companies, at least—provides the most bang for the buck. The catch is that what one mail-order company offers may not be the same as what another company offers, even when their packages include drive models with the same names and numbers.

Most mail-order companies buy their wares from distributors rather than directly from manufacturers. The distributors buy and then package the components sold by the factories. Although the distributors may all include drives from Seagate in their fixed-disk XT-class packages, they might include controllers from different companies, cables from still other vendors, utility software from additional parties, and manuals from yet different sources.

DELUXE OR BARE-BONES Some larger mail-order companies act as their own distributors by ordering the components and boxing them themselves. Others tell their distributors what they want the



Mail-Order Hard Disks: A Survey of Reader Experiences

Did you have any problems buying your hard disk by mail order? That's the first question anyone thinking of purchasing a hard disk via that method is going to ask a friend who has already done so.

We were curious, too. So we asked our readers. We posted a survey on the PC Magazine Interactive Reader Service, the bulletin board from which you can also download programs published in the Productivity section of this magazine. The survey questioned readers who had purchased their add-in hard disks by mail order on their experiences: 241 readers responded. The results, published here, were encouraging.

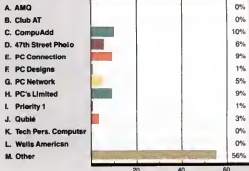
We found that the Seagate hard disk drives were the ones most often bought this way, amounting to 55 percent of the disk drives purchased by our surveyed readers. Miniscribe, with 13 percent, placed a distant

second. The vast majority of these drives were 20-megabyte drives for an XT.

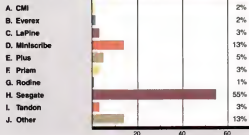
Were people happy with their choices? You bet. Eighty-seven percent said they would order from the same firm again. The majority of the respondents rated the companies highly on all questions asked, ranging from the courtesy and knowledge of the salesperson, promptness in filling the order, and completeness of the kit to the quality of the documentation and technical support. So go ahead. Just take a few precautions and rest easy when you purchase your mail-order hard disk.—Cheryl J. Goldberg and Christopher Barr

Cheryl J. Goldberg is an associate editor of PC Magazine; Christopher Barr is PC Magazine's Interactive Reader Service manager.

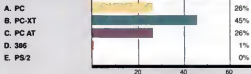
1. From which mail-order firm did you order your hard disk?



2. What brand of hard disk did you order?



3. For what class of machine did you order your hard disk?



4. How many megabytes does the hard disk you ordered hold?



5. What was the approximate date you purchased the hard disk?



Questions 6 through 10 are based on a scale of 1 to 5, with 5 being excellent and 1 being poor.

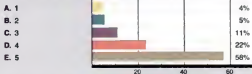
6. How would you rate the courtesy and knowledge of the salesperson?



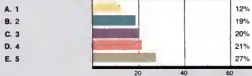
7. How would you rate the company's promptness in filling the order?



8. How would you rate the completeness of the kit?



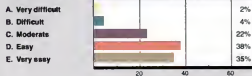
9. How would you rate the quality of the documentation?



10. How would you rate the quality of the company's technical support?



11. How easy or difficult was it to install the hard disk?



12. Would you order products from the same firm again?



Percentages do not always add up precisely to 100 because numbers were rounded off; they are based on the total number of respondents that purchased hard disks by mail.

■ MAIL-ORDER HARD DISKS

hardware packages to include. So the companies have a choice: they can sell barebones packages that come with nothing more than the drive, controller, cables, and the factory product manuals, or they can sell deluxe packages that include manuals especially written for a certain combination of hardware and circuitry, perhaps with a bonus of some utility software.

The economics of buying in large quantities, both by the distributor and by the mail-order company, make it possible to sell a deluxe hardware package almost as inexpensively as a stripped-down package. So price is not always an indication of what you're buying.

It's your job to find out exactly what's included in the package. How? Ask the companies.

Q & A Here are some of the questions you'll want to ask the sales reps. In our features table we provide the answers for the drives tested, but you'll need to ask them of other vendors for yourself.

What comes in the box or with the product? Will the disk drive work in your present system? Is anything else necessary to install, set up, and use the disk drive? Does any software come with the disk drive? What manuals and installation guides are supplied? Are there any extras like utilities that come with the drive? Are any special tools necessary to install the disk? Has the equipment been tested? Does it meet government specifications for home use? (You'll also want to ask questions that will tell you about the company. We tell you more about that part of the mail-order equation below.)

If you don't get all the information you want, ask for technical support. Quiz the technicians. Finally, check around to find someone who has recently bought a hard-disk package from one of the companies. Try leaving a message on your local bulletin board (on-line or on-wall) requesting advice and information about the products you're considering and the companies offering them. (We asked our readers about their experiences with mail-order hard drives and mail-order companies. You'll find the results of our Interactive Reader Service survey in a sidebar to this article, "Mail-Order Hard Disks: A Survey of Reader Experiences.")

When you've made all your calls and conducted other research on what each company includes in its package, consider what each of the components is worth to you. For example, if you've never installed or used a fixed disk before, you'll want the manual to be a complete, easy-to-follow user manual rather than a factory

■ If you can't find ads for a company appearing more than 3 months back, take your business elsewhere.

booklet listing technical specifications. If you really don't want to be bothered by the details of preparing the fixed disk for use, you might want initialization and utilities software. Then ask yourself: are the extras being offered necessary for your work, or would they simply take up shelf space in your office?

RISKY BUSINESS? The next step is to evaluate the companies that offer the package you need. We'll tell you about five companies that offer the standard hard drives we tested; you'll want to compile the same sort of information about any mail-order company you're evaluating.

All your precautions notwithstanding, mail-order buying will always entail some risk, like everything else in this world. Financially unstable companies are one source of risk. Mail-order companies with the best intentions have been known to go belly up, forcing them to file Chapter 11 and leave customers with empty mailboxes.

Fraud is another risk. In one case, Tech PC of Anaheim, California, continued to accept orders and payments after it had decided to go out of business. The whistle was not blown until customers called to find out the status of their orders and found the telephone disconnected. By that time, the company's directors had skipped town, leaving an empty warehouse behind.

To minimize the risk of doing business with an unstable or fraudulent mail-order company, protect yourself. Get recommendations before you buy. Find people who have dealt with mail-order companies recently; ask them about their experiences. You can even ask the companies themselves to supply references for you to call.

One way to judge a company is by how long they've been in business. Duration does not always indicate a safe company, but older companies for the most part are likely to be around for a while. Look at back issues of magazines like this one—have the companies been advertising for a few years? Also ask the company when it opened for business. Solid companies have nothing to hide.

If you can't find out how long a company has been operating and you haven't found any ads for it appearing earlier than 3 months ago, take your business elsewhere. In most fraud cases a company runs ads for 1 or 2 months and then flies by night.

Skepticism is an appropriate attitude to adopt when ads promise the world. Unless one of the companies specializes in the particular product, the two lowest prices you find advertised should be fairly close. A \$40 price difference on fixed disks is normal; \$100 would be suspect.

If the company lists a post office box number, be sure it has a street address as well. A street address generally indicates a real location, an office somewhere with people in it. If the company has a retail outlet, so much the better.

PROTECT YOURSELF Your best protection is to buy with a credit card. Using a card safeguards you against fraud and poor business practices, and it helps ensure satisfaction. Under the federal Fair Credit Law, if you're not satisfied with any purchase, you have the right to return it and have the charge removed from your bill within one billing cycle. If you can't get the credit from the mail-order company, contact your bank or credit-card company. They'll process the credit, charge back the mail-order company, and act as your representative.

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	SI	Sieve MS C (sec)	Shuttle Regen (sec)	Price
PC	1.0	5.88	100 (12)*	-
9 MHz FastCACHE-286	7.1	1.32	28 (7)*	\$349
12 MHz FastCACHE-286	10.3	.93	22 (6)*	\$599

*Times in parentheses are with an 8087 or 80287.

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CIRCLE 743 ON READER SERVICE CARD

■ MAIL-ORDER HARD DISKS

In the event of fraud, by the time the postal inspectors or other regulatory agencies get involved and catch up with those responsible, the money is gone and nothing's left for you. Pay by check as a last resort, only when you're certain that the company is stable and trustworthy.

Exercise your rights under the law. Federal statutes as well as state laws regulate mail-order businesses, specifying how soon they must fill orders, what notice they must give of delays, and how soon they must process refunds. Poor service often violates the law too. For example, when the seller quotes a delivery date, it must deliver by that date. If it quotes no date, it must deliver within 30 days or else notify you in writing of the new delivery date and

you're a PC novice, on the other hand, you'll want to buy from a company that offers as much support as possible, in every possible form—clear installation guides and complete user manuals, toll-free tech-

nical assistance, preinitialized hardware, user-oriented software, money-back guarantees, full warranties, and so forth.

You can begin to assess the company's support style when you're asking them

■ Using a credit card for mail order purchases safeguards you against fraud and helps ensure satisfaction.

allow you to cancel the order and receive a full refund—within 7 business days or within the next billing cycle for your credit card. Also, be wary of long delivery periods; they could be designed to let a disreputable company take the money and run.

Learn more about your consumer rights by calling or writing the Federal Trade Commission office in your area. Or call the Direct Mail/Marketing Association in New York for information: (212) 689-4977.

SUPPORT STYLES What makes a mail-order company the right one for you depends to a great extent on what kind of support you need from it. In turn, the support you need is in direct proportion to your knowledge of and experience with your PC and the product you're buying. If you've installed a fixed disk before, you could be comfortable buying one from a company that offers no more help than rudimentary installation instructions. If

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TAX LAW THREAT

Escaping the sales tax is a strong incentive for buying a hard disk by mail order. If H.R. 1242 becomes law, that incentive will cease to exist.

State governments are unhappy about missing out on billions of dollars in revenue, since out-of-state mail-order customers pay no sales tax. The House of Representatives is considering the Interstate Sales Tax Collection Act of 1987, H.R. 1242, which would require all mail-order vendors to collect and pay sales taxes to every state—and to a lot of municipalities—from which their customers buy products.

Mail-order companies make the far-fetched claim that the law would put them out of business. To compete in the tough computer mail-order market, they

depend on large sales volume and low administrative costs. Having to collect sales taxes would burden them with the expense of a larger administrative function. They would have to keep track of the sales taxes in each state and also in those counties and cities that collect additional taxes. Each company would be required to file sales tax returns and would be subject to audit by literally hundreds of different governments.

But the truth is that purchasers are not currently exempted from paying the sales tax on out-of-state mail-order purchases. Your home state expects you to volun-

tarily report out-of-state mail-order purchases and pay tax on them. Of course, no one does.

The proposed law, then, will simply close this loophole. While mail-order companies will now have to charge slightly higher prices in order to pass along the extra costs to customers, their prices are so much cheaper than retail that the new law will have little effect on their business. In addition, government and business buyers, who place orders for large quantities, will be unaffected by the law since they are exempt from sales tax.—Walt Rowinsky

about what's in the package. Mail-order companies are pretty consistent. If the sales people are reluctant to answer your questions or to refer you to someone who can, you can be pretty sure you're not going to get much in the way of other support later on. But if you get a poor response the first time you try, call again and give the staff a second chance to prove themselves. That way you'll have more basis for evaluating the sales and support team.

GUARANTEES Find out how much the company is willing to back up your purchase. Does it offer a money-back guarantee? If so, what are the terms and restrictions? Can you send back the drive for a refund simply because you didn't like it, or do you have to prove that it's defective? Do you get the cash back, or just credit for another purchase?

A complete money-back guarantee, preferably one with few restrictions, will be especially important if you're not sure that the hard drive is exactly the kind you need. A money-back policy also gives you an out if the drive turns out to be clunky or temperamental but technically OK, or if you find exactly what you need from another vendor at a significantly lower price while awaiting delivery.

■ When a mail-order company offers the warranty, you can be pretty sure that it believes in the product.

A trade-up policy is almost as good as a money-back guarantee. It at least assures that you won't get stuck with insufficient drive power, permitting you to exchange the fixed disk for a larger or faster one.

SECURITY BLANKET Make sure you're covered by the security blanket of a good warranty. Warranties come in all shapes and sizes, and with various wait periods. The best ones are those that entail the least inconvenience if something does go wrong with the drive. Obviously, the longer the warranty continues in effect, the better.

The most convenient warranties are issued directly by the mail-order companies

rather than the product manufacturer. When a mail-order company offers the warranty, you can be pretty sure that it believes in the product, and you know what kind of operation you'll be dealing with if something goes wrong.

The second-best kind of warranty is issued by a third party but administered by the mail-order company. In that case, the factory or distributor services the drive, but you deal only with the company that supplied it to you. Some mail-order companies are also warranty and repair stations for drive manufacturers.

Third in the warranty lineup is a third-party warranty under which you deal directly with the distributor or system integrator. That arrangement means there's more distance between you and the help you'll need if something goes wrong.

The warranty with the least value, in most cases, is the factory warranty. Seagate, for example, issues warranties for its disk drives for 1 year from the date it sells them. That means the clock starts ticking the moment the distributor places the order. Depending on how long the drive sits idle on the distributor's shelf and on the shelf at the mail-order house, you could end up with no warranty at all. So drives advertised as being under factory warranty

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Comparing the features.

Features	ULTIMATE EGA +	Genoa Super EGA	Quadram EGA Prosync	IBM EGA	Paradise FAEGA
Compatible with EGA	•	•	•	•	•
Compatible with CGA and MDA	•	•	•	• (1)	•
Compatible with Hercules	•	•	•	•	•
Automatic Switching among EGA, CGA, MDA and Hercules Modes	•	•	•	•	•
Video Memory Size	256K	256K	256K	64K	256K
Runs 132 columns on among EGA and TTL Monochrome Monitor	•	•	•	•	•
Supports VGA Display resolution (640 X 480)	•	•	•	•	•
Special G-Font Mode displays up to 8192 programmable characters in 16 colors (2)	•	•	•	•	•
Microsoft Bus Mouse Compatible Interface	•	•	•	•	•
Parallel Printer Port	•	•	•	•	•

(1) Compatible only to the BIOS level, will not be compatible with most game software.

(2) Standard G-Font provides up to 2048 characters, 1 Mbyte memory required if up to 8192 characters.

One card does it all by JUKOTM G7 series.

Features	G7-A	AUTO G7-A	G7-AS	G7-B	AUTO G7-B
Compatible with CGA and MDA	•	•	•	•	•
Compatible with Hercules	•	•	•	•	•
Connects to composite Green/Color Monitor	•	•	•	•	•
Connects to 640 X 480 Hi-Res Color Monitor (Hor. Scan rate 24.75KHz)*	•	•	•	•	•
Connects to PAL/NTSC system TV	•	•	•	•	•
Microsoft Bus Mouse compatible interface	•	•	•	•	•
Parallel printer port	•	•	•	•	•
Game port	•	•	•	•	•
Light Pen interface	•	•	•	•	•
Runs CGA software on a TTL Monochrome Monitor	•	•	•	•	•
Software selectable CGA and MDA	•	•	•	•	•
Serial RS232C port	•	•	• (A)	• (B)	• (B)
Clock/Calendar standard	•	•	•	•	•
Floppy Disk Drive controller	•	•	•	•	•

* Optional Modulator required (A) Serial Port Controller (B250 and 16450) (B) Two Serial Ports (One Standard, One Optional)

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Benchmark Tests: Mail-Order Hard Disks

All five mail-order companies recommended the Seagate ST4036 for AT-class machines. This disk drive's performance was comparable to that of a standard IBM PC AT with a 20-megabyte hard disk, despite the larger (30-megabyte) disk capacity.

Among the XT-class units tested, the Seagate ST225 drive was somewhat faster than the standard 10-megabyte IBM PC-XT drive, but the Everex controller used with some of the ST225s caused a drop-off in performance on the Sequential write benchmark test.

The DOS Disk Access benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 5 and the interface factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

The File Access benchmark test measures the time it takes to sequentially create and write a 256K-byte data file using record lengths of 512 bytes and 4K bytes. The test program then performs a series of operations: a sequential read of the same file, a random write, and a random read.

XT-Class Drives Performance Times

(Times given in seconds except where noted)

	DOS Disk Access (milliseconds)	BIOS Disk Seek (milliseconds)	File Access			
			Sequential create	Sequential write	Sequential read	Random write
IBM PC-XT with 10-Mbyte hard disk	114.2	95.3	11.8	11.9	11.7	30.2
Seagate ST225 with Western Digital WD1002A-WX1 controller	98.2	78.0	12.3	12.1	12.0	29.5
Seagate ST225 with Everex EV361 controller	90.8	71.5	11.8	20.0	11.5	29.8

AT-Class Drives Performance Times

(Times given in seconds except where noted)

	DOS Disk Access (milliseconds)	BIOS Disk Seek (milliseconds)	File Access			
			Sequential create	Sequential write	Sequential read	Random write
IBM PC AT with 20-Mbyte hard disk	43.5	37.4	9.4	20.4	8.7	17.3
Seagate ST4036	43.5	34.6	10.2	10.2	10.1	19.1

may actually carry no warranty.

Find out how the warranty policy works. Under a direct replacement warranty (the most beneficial arrangement), if your drive becomes defective, you send it in and the mail-order company sends back a new one. That way you're not left without a fixed disk while it's off being repaired.

Also ask about the procedure for returns. Standard mail-order practice is that you must call the support technicians, and they will try to diagnose the problem over the phone. If they fail, you ship the drive back.

Shipping policies also vary widely. Get all the details. How long after you place the order will the drive actually leave the warehouse? Same-day or next-day shipping is preferable. Also ask about delivery charges and methods, additional charges for faster delivery if available, and other pertinent details.

SOMEBODY HELP Technical support is an important consideration. Most reputable mail-order companies give you a telephone number to call if you need help with your disk. Before making a purchase, call the technical support staffs of the companies. If you don't know what to ask, play detective and tell them you don't have the user manual but need to know how to install the drive (since you won't have an invoice number, you can say the drive was a gift). Their instructions will help you decide whether they're knowledgeable and willing to give you as much time as you'll need to fix a problem—45 minutes to an hour if necessary.

Also, find out who pays for the call; toll-free technical support is best. And will you be able to get help when you need it? If you're buying a drive for your PC at home, even a toll-free technical support number may not be worth very much if help is available only during work hours, when

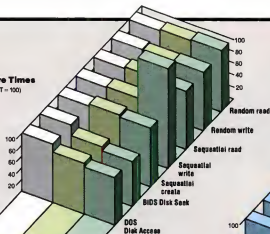
you're away from your home machine.

Inquire about extra help that may be available. PC Connection supplies a 15-minute instructional videotape cassette so that its customers can see—not just read about or listen to—the right way to install a fixed disk.

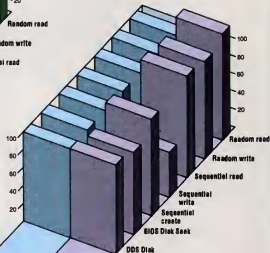
ADDED CHARGES Ask for the real, full price of the fixed disk. Will any additional charges be tacked on to the advertised price? A shipping fee is the most common extra charge, although many companies include shipping costs in the advertised price.

Another additional charge may be a surcharge on purchases made with a credit card. The practice of adding a credit-card surcharge is less widespread today than a few years ago, but some companies still demand a percentage of the total cost (including shipping) of any purchase made with a credit card. Such surcharges, usual-

Relative Times
(IBM PC-XT = 100)



Relative Times
(IBM PC-XT = 100)



ly in the 2 to 5 percent range, reimburse the company for the bank fees it pays for accepting credit cards.

You won't have to pay sales tax when you order from an out-of-state company—unless Congress passes a bill the House of Representatives is considering. (See the sidebar "Tax Law Threat," which discusses this legislative change, for more information on how it would affect the mail-order business and its low prices.)

MORE ANSWERS When you've found out the answers to your questions, you'll be in a good position to choose the best deal and the best company to deal with. And you'll probably have a much better idea of what you really need, plus what your chances of getting it are.

In the following pages, we review the low-cost 20- and 30-megabyte drives sold by the five mail-order companies. And we discuss the companies themselves.

But remember, to get the best deal, you need to do your homework. Use this information as a starting point; then get busy asking questions.

20-MEGABYTE XT-CLASS HARD DRIVES The most popular 20-megabyte hard drive sold by four of the companies—47th Street Computer, Lifetime Memory Products, PC Connection, and Priority 1 Electronics—is an entry-level Seagate drive, the Model ST225 half-height 5¼-inch disk drive. These companies sell the drive with a Western Digital WD1002A-WX1 half-length controller card. This drive will also run with the controller that you already have inside your XT.

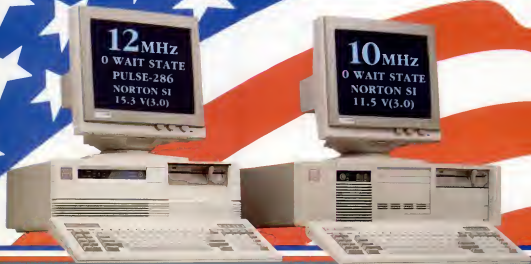
In operation, the Seagate ST225/Western Digital WD1002A-WX1 pairing isn't going to break any records. It's a workhorse combination that provides you with quiet-running XT-class performance in the

80-millisecond seek-rate range.

The other 20-megabyte hard drive, which PC Designs sells, is the same model Seagate hard disk—the ubiquitous Model ST225—but with the Everex 391 controller. The drive tested in the 70-millisecond seek-rate range—a bit faster than the same drive with the Western Digital controller from the other companies. But the PC Labs benchmark tests also indicate that the Seagate ST225 used with the Everex 391 controller scored lower on the sequential-writing test than the same model drive with the Western Digital controller.

The PC Labs benchmark tests show additional access times for the Seagate Model ST225 with both controllers. The complete package each of the companies offers is described below, along with the company's performance. Prices for these packages ranged from \$299 to \$335 during our testing period. (All prices are, of course, subject to change as the market and avail-

The American Success Story Continues..



CLUB 286 (12MHz Zero Wait State) (16MHz Throughput) Mono System **\$1695**

- 12MHz Zero Wait State 80286 /• 16MHz Throughput /• Small Footprint Chassis /• Secured Hardware Reset /• 12" Monochrome Monitor (800x350) /• Hercules Compatible 132 Column Video Card
- Speaker On / Off /• Standard 1MB Memory /• Norton SI V.3
- Keyboard Selectable Between 8/12 and Zero/1 Wait State
- Plus Basic System Features /• Made in U.S.A.

12MHz EGA System \$2065

Basic System Features:

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- 220/110V (UL, CSA) /• Fully Compatible AMI BIOS (Written in USA)
- 200 Page Documentation and User's Guide /• Limited One Year Warranty
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Prices and Terms: All prices are subject to change and quantities may be limited and we reserve the right to substitute equivalent items. Unavailable items are subject to a 15% surcharge for RMA numbers must be attached to all returned items and must be sent shipping prepaid by customer. The United warranty is 1 year on parts and 90 days on labor



CLUB 286 (10MHz Zero Wait State) (12MHz Throughput) Mono System **\$1529**

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- 12MHz Throughput /• 2 Serials, 1 Parallel Port Built In
- Norton SI-V(3.0) 11.5 /• Plus Basic System Features /• Made in U.S.A.

10MHz EGA System \$1895

286 System Options

20MB 65ms Half Height	\$280	80287-8	\$235
30MB 30ms Full Height	\$500	80287-10	\$310
44MB 28ms Full Height	\$575	Optical Mouse	\$99
72MB 23ms Full Height	\$920	Mechanical Mouse	\$69
71MB 28ms Full Height	\$870	14" Flatscreen Everspion	
130MB 18ms Full Height	\$1800	Mono Monitor	CALL
NEC Multisync	CALL		

All 14" Flatscreen monitors shown above are optional

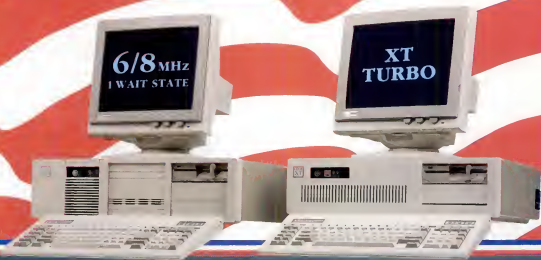
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CLUB 286 (8MHz 1 Wait State) 8MHz Monochrome System

- Includes Basic System /* 12" Monochrome Monitor (800x350) /* Hercules Compatible 152 Column Video Card /* Made in U.S.A.

Special Only

\$995

8MHz EGA System **\$1399**

CLUB Turbo 4.77/8.0MHz Monochrome System

\$699

- 8088-2 Keyboard Selectable /* 256K Standard /* 12" Monochrome Monitor (800x350) /* Hercules Compatible 152 Column Video Card
- 135 Watt Power Supply

4.77/8MHz EGA System **\$1150** 20MB System Add **\$300**

Model	Pulse 286	IBM	PC Limited	COMPAG	Premium 286
Processor	80286-12	80286-10	80286-12	80286-12	80286-10
Clock speed					
Wait States	0	1	0	1	0
Mean S/G	16.3	10.1	13.3	11.5	11.5

Mean S/G	16.3 - 6.82 (Fast Count)
Mean S/G	10.1 - 9.52 (Fast Count)
Mean S/G	13.3 - 5.00 (Fast Count)
Mean S/G	11.5 - 6.00 (Fast Count)

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■ MAIL-ORDER HARD DISKS

ability fluctuate; so are company policies, hours, additional charges, and the components of each package.)

30-MEGABYTE AT-CLASS HARD DRIVES All five companies offer the venerable Seagate ST4038 hard disk as their standard 30-megabyte drive. The ST4038 is a full-height 5¼-inch disk drive. It's the drive that defines AT-standard performance.

Prices for the 30-megabyte packages ranged from \$485 to \$599 at the time we evaluated them.

PC Labs tests, run after the drive was installed, indicate a 40-millisecond seek rate. Additional performance times appear in the benchmarks table.

How valuable this drive will be to you depends on the specific package each company offers and the support you receive. Here's what we learned about that part of buying a mail-order hard disk drive.

■ ■ ■ ■ 47th Street Computer

Depending on your general outlook on life, dealing with New York's 47th Street Computer can be an adventure or a chore. It all begins when you dial the toll-free mail-order sales number. You'll find someone there between 9 A.M. and 6 P.M. EST on weekdays and from 10 A.M. to 4 P.M. EST on Sunday.

Expect to be put on hold immediately, before you get to talk to anyone. The phone desk is either very busy or very understaffed. When you do finally hear a human voice, expect to be rushed, or if you need answers, be ready to play Twenty Questions. The salespeople aren't going to volunteer information. You have to push for it.

But if you do your homework and know exactly what you want, you can take advantage of the company's very low fixed-

disk prices. At \$319, the cost of 47th Street's 20-megabyte package for the XT was close to the lowest among the companies reviewed. Similarly, although it wasn't the cheapest, the AT drive (\$549) compared favorably. To figure what will show up on your MasterCard statement, add shipping, a minimum of \$6.

Shipping is normally via UPS ground service. And although the salespeople don't seem willing to predict when your purchase will arrive, you can be sure it will get out the door pretty quickly. A quick check with 47th Street customers who responded to *PC Magazine's* survey on buying fixed disks through the mail indicates that little time lapsed between the time orders were placed and when they arrived.

The prices are low because there aren't any frills, money-back guarantees, or trade-up policies. The only reason you can return a disk drive is that it's defective. 47th Street covers its XT drive packages

20-Mbyte Seagate ST225 with Western Digital WD1002A-WX1 controller:

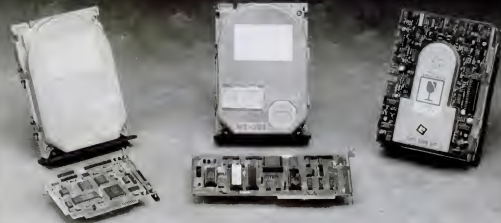
- Lifetime Memory Products
- PC Connection
- 47th Street Computer
- Priority 1 Electronics

20-Mbyte Seagate ST225 with Everex EV391 controller:

- PC Designs

30-Mbyte Seagate ST4038

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Sweepstakes



LOGICSOFT®

announces the "Yes, yes, yes, you too can live (at the taxpayer's expense) like royalty" sweepstakes. It's a week, you'll talk about for the rest of your life! A vacation money can't buy!!

You and three guests will be flown to a sumptuous villa, somewhere in the West Indies. For 8 days and 7 nights, you'll have an opportunity to live like only a select few in this world do!

The Grand Prize villa is owned by royalty, and used by their family and friends. You'll enjoy the same exact luxuries the owners do—the housekeeper, the gardener, the cook, the Land Rover, the private beach, the swimming pool—need we say more!???

Yes, we do! You'll live on the same tiny island as, uuhhh, right next door to, uh, er, let's just say oodles of famous people—rock stars, politicians, movie stars, more royalty—people you only read about in the National Enquirer!!

You'll enjoy all these sensuous pleasures in a secret place in the West Indies, at the villa of a royally famous individual. So royal and so famous that we can't even tell you who it is!! Due to protection of privacy, we had to sign a contract stating that we would not disclose the owner of the villa, nor the exact location of the island. So nobody knows, with the exception of the pilot (someone has to get you there!!), and of course you, the winner.

But who cares?? For 1 whole entire week it will be yours and only yours, to use but not abuse; to use the same "water closet" — uses!! (Ha!! Thought we'd give the secret away??) In addition to a week of pure, unadulterated paradise, Logisoft will give you \$1000 cash, to spend as you see fit. But, with everything included in this dream vacation, you may very well end up taking the money home with you.

EVERYONE'S A WINNER See inside for details.

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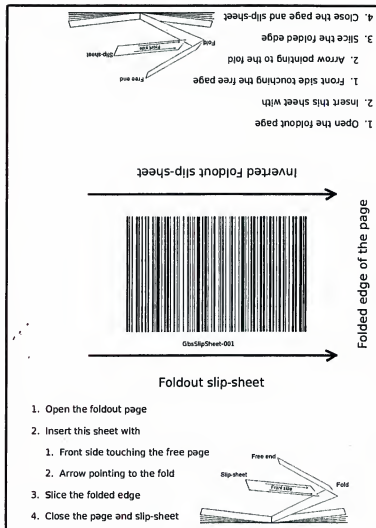
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**FOR LOGICSOFT'S
MONTHLY FEATURES
SEE PAGE 255!**



Inverted Back

Gbs⁶HpBack-CO2R

Back

1. Follow instructions on the other side

NEW-BACK-G

And your chance to live like royalty!

Ohh, my, my, what a sweepstakes! Just look at where you could go—

GRAND PRIZE 8 days and 7 nights for four people at a Caribbean island villa, including round trip air fare.

But that's not all —

FIRST PRIZE (3 winners) choose any one of three (3) vacation packages for two including airfare A) One week Caribbean cruise departing from San Juan; B) One week in Honolulu; C) One week in Acapulco.

But we said everybody's a winner!!

EVERYBODY WINS a \$100 TravelDollars certificate*, redeemable on any vacation package, including air and ground accommodations, from a printed brochure. Just go to any travel agent and find a vacation package that most appeals to you, and bring the printed brochure home with you. Then call the telephone number on the back of your TravelDollars certificate, explain what you wish to do, and the reservations will be made. It's that simple!!

Ohh! One more thing —

EVERYBODY WINS a \$10 Logisoft discount coupon, good towards your next Logisoft purchase. So now not only have you entered this stupendous sweepstakes, but you're getting an additional \$10 off Logisoft's already low prices on their entire inventory, and you still get their 30 day money-back guarantee!! Whatta deal!! You receive both the TravelDollars certificate and the Logisoft coupon when you receive your order, the same order that entered you in the sweepstakes.

SO, C'MON, CALL LOGISOFT NOW, AND LIVE LIKE ROYALTY!!

*TravelDollars certificates can be used with any vacation package including air and ground accommodations from a printed brochure. Minimum purchase \$500 per person. Certificates cannot be combined for use on a single trip.

OFFICIAL SWEEPSTAKES RULES

1. No purchase necessary. For every product ordered by phone or mail during the period September 1 through December 31, 1987, you will automatically be entered in the sweepstakes (i.e., 3 products = 3 entries). Phone and mail orders must be received by December 31, 1987. You also may enter by hand printing your name, address, telephone number, and "Logisoft Live Like Royalty Sweepstakes" on a 3x5 card and mailing it in an envelope, to LOGISOFT SWEEPSTAKES, P.O. BOX 19-1784, MIAMI BEACH, FLA 33119, to be received by 12/31/87. Only one entry per envelope. Mechanical reproductions are not acceptable. Logisoft is not responsible for late, lost, or misdirected entries.

2. Winners will be selected in a random drawing by an independent judging organization about January 15, 1988. Winners will be notified by mail and may be required to sign an affidavit of eligibility and liability, publicly release within 21 days of notification. Travel companions of winners will be required to sign releases. All taxes are the sole responsibility of winners. Odds of winning depend on number of entries. All prizes will be awarded. No transfers of prizes and no substitutions except by Logisoft due to prize unavailability.

3. PRIZES: One (1) Grand Prize of a one week (8 days, 7 nights) vacation for four people at a Caribbean island villa consisting of round trip air travel from any international airport

in the continental United States, \$1,200 cash allowance for meals and beverages, the services of a cook, maid, and gardener at the villa; use of a golf and a cash allowance for fuel, and \$1,000 cash approximate retail value \$15,000. Three (3) first prizes. Choose from any of these vacation packages, at (One week Caribbean cruise departing from San Juan; One week in Honolulu; One week in Acapulco) all packages are for two persons and include round trip air from major gateways, 7 night accommodations, taxes, tips, and other extras as described in the tour operator's brochures. Cruise also includes food. Approximate retail value of the first prizes are \$4,700.00. ONLY ONE PRIZE PER PERSON.

4. Sweepstakes open to legal residents of the U.S., age 21 or over, except employees and their families of Logisoft, Inc., its affiliates, subsidiaries, and advertising agency, and Lexington Productions, Inc. Void in FL and where prohibited or restricted by law. By participating you agree to these rules and the decisions of the judges.

5. For a list of major prize winners, send a self-addressed stamped envelope to LOGISOFT SWEEPSTAKES, P.O. BOX 19-1784, MIAMI BEACH, FLA 33119 by 2/15/88.

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Our terms customers can be assigned a
personal account executive and may
qualify for special corporate considerations.

■ MAIL-ORDER HARD DISKS

with a 90-day warranty on the drive and controller, plus the manufacturer's warranty. The 30-megabyte AT drive is covered for 1 year.

The technical service staff are pretty sharp, though. They know what questions to ask and are able to solve most common problems over the phone, as well as many uncommon ones. If they can't figure out what's the matter, they'll issue a return authorization and you can send them your drive. 47th Street will even pick up the tab for the shipment; just request permission to send it UPS collect.

When your fixed disk arrives in New York, the staff tests it. If it's broken, you get a new one, and none of your time is wasted while you wait for repairs. Figure turnaround time at about 1 week.

20-MEGABYTE DRIVE The company's 20-megabyte fixed-disk package for the XT (\$319) is the Seagate ST225 half-

height 5¼-inch disk drive with the Western Digital WD1002A-WX1 half-length controller card. The drive is standard, but the supporting documentation is another matter. Three mismatched documents came in the box. To get installation right the first time, you have to juggle them a bit, using only some information from each.

The owner's manual is out of date and concerned mostly with how to install the disk drive physically in a standard dual-floppy-disk-drive PC. If that's the kind of machine you have, follow the instructions on how to remove one floppy drive, install the fixed drive and controller, and hook up the cables. But don't go any farther.

If you're installing in an XT, consult Seagate's Universal Installation Handbook, a rather technical pamphlet that clearly explains how to configure your ST225 and which controller cable connector to hook up to. Once the drive's installed in the machine, follow the procedure on Western Digital's low-level-format instructions sheet to prepare it for use. You have to use the DOS DEBUG utility program to get the low-level format going and then partition the drive with FDISK and run FORMAT.

Give yourself about 45 minutes to get the job done. The low-level format runs a little slowly, and you'll need time to sort through all the instructions. If you have any unusual installation requirements, such as installing the drive in an old model PC-1, you should call the technical support number.

All in all, if you're comfortable with tackling a little inconvenience for the sake of saving ten bucks, this XT fixed-disk package is a good choice. If you have any doubts, use one of the other mail-order companies.

30-MEGABYTE DRIVE The company's 30-megabyte AT fixed-disk hard drive package (\$549) is atypical of what the company has available. All the hardware arrived—the Seagate ST4038 full-height drive, the data cable, and the mounting hardware—but none of the right documentation was included.

What showed up in the box was the distributor's owner's manual, which had nothing to do with this drive at all, and a

sheet listing disk drives and their correct IBM PC AT drive types.

47th Street was quick to respond to the call for help. After a quick apology for the inconvenience, the salesperson promised to send a replacement installation manual. What arrived in the mail was Seagate's

■ If you're comfortable tackling a little inconvenience for the sake of saving \$10, 47th Street Computer's XT fixed-disk package is a good choice.

Universal Installation Handbook. That gets you through the physical installation but leaves you out in the cold as to what to do next.

The technician we called at 47th Street was helpful, if a bit brusque. He asked the right questions and then rattled off a set of clear instructions.

Installing this drive as the only one in your AT is simple enough. The drive comes configured as drive 1, so just slide it right into your fixed disk bay and hook up the cables. Then turn on the machine, run the SETUP program and input the drive type from the sheet included in the box, and run FDISK to partition the drive and FORMAT. 47th Street does us all a great favor by providing the disk drive already low-level-formatted.

At its price, this package would easily place a comfortable second among the AT drive packages reviewed. But the poor documentation makes the product impossible to recommend to anyone except those users who already know how to get it up and running.

That's the full extent of 47th Street Computer's services. If you know what you want, that's really all you need. The prices are low enough to make the work you do pay off.



FACT FILE

47th Street Computer
36 East 19th St.
New York, NY 10003
(800) 221-7774

Seagate ST225

List Price: \$319; not available without Western Digital WD1002A-WX1 controller.
Requires: DOS 2.0 or later.
Capacity: 20 Mbytes.
Size: 5¼-inch half-height.

In Short: The hardware is good, but the documentation leaves a lot to be desired. Still, if you know what you're doing, this is the one to buy if you want an XT drive for very little.

CIRCLE 68 ON READER SERVICE CARD

Seagate ST4038

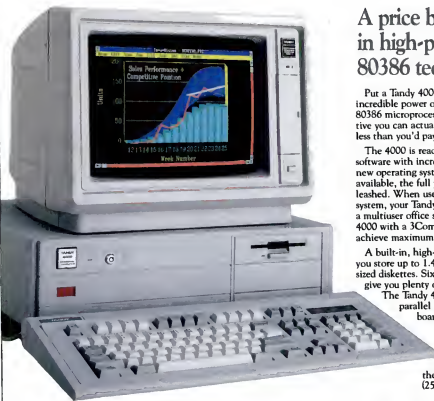
List Price: \$549
Requires: DOS 2.0 or later.
Capacity: 30 Mbytes.
Size: 5¼-inch full-height.

In Short: Poor documentation buries an otherwise solid package. You can work around that with a phone call, but even at this low price, don't you deserve better?

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CIRCLE 289 ON READER SERVICE CARD

■ MAIL-ORDER HARD DISKS



Mail-Order Hard Disks:

Summary of Features

(Products listed in ascending base price order)

30-Mbyte AT Class



Mail-order company	Lifetime Memory Products	PC Designs	47th Street Computer	PC Connection	Priority 1 Electronics
Product	Seagate ST4038	Seagate ST4038	Seagate ST4038	Seagate ST4038	Seagate ST4038
Base price	\$485	\$529	\$549	\$567	\$599

BASE PRICE INCLUDES

Hardware	Fixed disk, mounting rails	Fixed disk, mounting rails	Fixed disk, full-height faceplate	Fixed disk, mounting rails, mounting screws	Fixed disk
Software	Lifetime Backup Utilities	Everdisk HardDisk Utility Software	None	None	None
Cables	Data cable	Data cable	Data cable	Data cable	None
Documentation	Lifetime Memory Products installation manual, Lifetime Backup Utilities manual, Seagate factory test sheet, hard error map	Everdisk instruction manual, Seagate factory test sheet, hard error map	Owner's Manual, Drive Type Sheet, Seagate factory test sheet, hard error map	PC Connection installation instruction sheet, Seagate installation instructions, Seagate factory test sheet, hard error map	Seagate ST4038 product manual, Seagate factory test sheet, hard error map

MISCELLANEOUS

Extra charges	None	Credit-card orders—2% extra charge	Shipping—\$6 minimum	Shipping—2% of drive price	Shipping—\$1 for first 2 lbs.; \$.60 each additional lb. (\$.35 in Calif.)
Payment accepted	MasterCard, Visa, personal and bank checks, money orders, COD	MasterCard, Visa, personal checks, money orders, COD for cashier or certified checks	American Express, MasterCard, Visa, personal and bank checks, money orders	MasterCard, Visa, personal and bank checks, money orders, COD	MasterCard, Visa, personal and bank checks, money orders
Warranty	Lifetime Memory Products—1-year replacement or repair; 90-day limited warranty on Lifetime Backup Utilities	PC Designs—1-year replacement or repair	47th Street Computer—1-year replacement or repair	PC Connection—1-year replacement or repair	Priority 1—90-day replacement or repair; Seagate—remainder of 1-year factory warranty
Return policy	60-day money-back guarantee	Replacement for defective products only	For defective products only	For defective products only	7-day money-back guarantee
Ordering hours	Mon. to Fri. 9 A.M. to 6 P.M. CST	Mon. to Fri. 8 A.M. to 6 P.M. CST, Sat. 8:30 A.M. to 3 P.M. CST	Sun. 10 A.M. to 4 P.M. EST, Mon. to Thurs. 9 A.M. to 6 P.M. EST, Fri. 10 A.M. to 2 P.M. EST	Mon. to Fri. 9 A.M. to 9 P.M. EST, Sat. 9 A.M. to 5:30 P.M. EST	Mon. to Fri. 7 A.M. to 5 P.M. PST, Sat. 10 A.M. to 5 P.M. PST
Usual delivery time	Approximately 1 week	Approximately 10 days	3 to 4 days	1 to 2 days	Overnight to 2 weeks
Technical support number	●	●	●	●	●
Toll-free	○	●	○	●	○
Technical support hours	Mon. to Fri. 9 A.M. to 6 P.M. CST	Mon. to Fri. 8 A.M. to 6 P.M. CST	Sun. 10 A.M. to 4 P.M. EST, Mon. to Thurs. 9 A.M. to 8 P.M. EST, Fri. 10 A.M. to 2 P.M. EST	Mon. to Fri. 9 A.M. to 5:30 P.M. EST, Sat. 9 A.M. to 12 P.M. EST	Mon. to Fri. 9 A.M. to 4 P.M. PST
No. of years company in business	1	3	14	5	11

PC—Indicates Editor's Choice ●—Yes ○—No

20-Mbyte XT Class



Mail-order company	PC Connection	PC Designs	Lifetime Memory Products	Priority 1 Electronics	47th Street Computer
Product	Seagate ST225	Seagate ST225	Seagate ST225	Seagate ST225	Seagate ST225
Base price	\$229	\$230	\$269	\$299	\$319
BASE PRICE INCLUDES					
Hardware	Fixed disk, half- and full-height faceplates, mounting screws	Fixed disk, mounting screws	Fixed disk, filler plate, mounting screws	Fixed disk, half- and full-height faceplates, mounting screws	Fixed disk, Western Digital WD1002A-WX1 controller, half- and full-height faceplates, mounting screws
Software	None	Everdisk HardDisk Utility Software	Fixed disk utilities, Lifetime Backup Utilities	None	None
Cables	Data cables	Data cables	Data cables	Data cables	Data and controller cables
Documentation	PC Connection installation instruction sheet, Seagate factory test sheet, hard error map, PC Connection installation videotape	Everdisk instruction manual, Seagate factory test sheet, hard error map	Lifetime Memory Products installation manual, Lifetime Backup Utilities manual, Seagate factory test sheet, hard error map	Seagate factory test sheet, hard error map	Owner's Manual, Seagate Universal Installation Handbook, Low-Level Format Procedure Instructions, Seagate factory test sheet, hard error map
TESTED CONFIGURATION					
Price	\$299	\$305	\$335	\$329	\$319
Tested configuration includes	All of the above, plus the Western Digital WD1002A-WX1 controller card and cables	All of the above, plus the Evers EV991 controller card and cables	All of the above, plus the Western Digital WD1002A-WX1 controller card and cables	All of the above, plus the Western Digital WD1002A-WX1 controller card, cables, and user guide	All of the above
MISCELLANEOUS					
Extra charges	Shipping—2% of drive price	Credit-card orders—2% extra charge	None	Shipping—\$1 for first 2 lbs.; \$.60 each additional lb. (\$.35 in Calif.)	Shipping—\$6 minimum
Payment accepted	MasterCard, Visa, personal and bank checks, money orders, COD	MasterCard, Visa, personal and bank checks, money orders, COD for cashless or certified checks	MasterCard, Visa, personal and bank checks, money orders, COD	MasterCard, Visa, personal and bank checks, money orders, wire transfers	American Express, MasterCard, Visa, personal and bank checks, money orders
Warranty	PC Connection—1-year replacement or repair	PC Designs—1-year replacement or repair	Lifetime Memory Products—1-year replacement or repair, 90-day limited warranty on Lifetime Backup Utilities	Priority 1—1-year replacement or repair	47th Street Computer—90-day replacement or repair; Seagate—1-year replacement or repair
Return policy	For defective products only	Replacement for defective products only	60-day money-back guarantee	7-day money-back guarantee	For defective products only
Ordering hours	Mon. to Fri. 9 A.M. to 9 PM EST, Sat. 9 A.M. to 5:30 PM EST	Mon. to Fri. 6 A.M. to 6 PM CST, Sat. 8:30 A.M. to 3 PM CST	Mon. to Fri. 9 A.M. to 6 PM CST	Mon. to Fri. 9 A.M. to 5 PM PST, Sat. 10 A.M. to 5 PM PST	Sun. 10 A.M. to 4 PM EST, Mon. to Thurs. 9 A.M. to 6 PM EST, Fri. 10 A.M. to 2 PM EST
Usual delivery time	1 to 2 days	Approximately 10 days	Approximately 1 week	Overnight to 2 weeks	3 to 4 days
Technical support number	●	●	●	●	●
Toll-free	●	●	○	○	○
Technical support hours	Mon. to Fri. 9 A.M. to 5:30 PM EST, Sat. 9 A.M. to 12 PM EST	Mon. to Fri. 6 A.M. to 6 PM CST	Mon. to Fri. 9 A.M. to 6 PM CST	Mon. to Fri. 9 A.M. to 4 PM PST	Sun. 10 A.M. to 4 PM EST, Mon. to Thurs. 9 A.M. to 6 PM EST, Fri. 10 A.M. to 2 PM EST
No. of years company in business	5	3	1	11	14

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CIRCLE 338 ON READER SERVICE CARD

■ MAIL-ORDER HARD DISKS

■ ■ ■ ■ Lifetime Memory Products

If you judge a mail-order company by its salespeople, you'd rate Lifetime Memory Products (in Austin, Texas) among the best. Lifetime's sales staff, whom you can call toll-free, are courteous and willing to take time to answer your questions in depth.

As with the other mail-order companies we contacted, you have to know what questions to ask. And the weekday-only hours from 9 A.M. to 6 P.M. CST mean you may have to sneak your call in from work.

But your call is worth the effort. Lifetime features some of the lowest fixed-disk prices. And you won't get any surprises when the MasterCard bill arrives. The price in the ad is what you pay, with no added shipping charges or other extra costs.

Nor do you have to worry about what UPS is going to leave on your doorstep. The quality of the 20- and 30-megabyte fixed-disk packages is high. The company specializes in selling only data storage systems for the PC, and it appears to be serious about building and maintaining a good reputation.

Lifetime's shipping policy could be a source of disappointment. Normal shipping, even on credit-card orders, is within five working days. You could find yourself waiting a week and a half or two weeks after you make your call. If you really have time to kill, send in a check. Like the other mail-order companies, Lifetime doesn't ship until after the check clears.

You get a 60-day money-back guarantee. If what arrives turns out to be not what you had in mind, make a phone call, return the drive, and get your money back—no questions asked. That guarantee can be a lifesaver if this is your first fixed disk. If

you find you need a bigger drive after a month's use, send the drive back and get the next size up. You'll have to swallow the cost of shipping the drive back, but that's a low price to avoid getting stuck with a mistake.

Lifetime's fixed disks are also covered by a 1-year parts and labor warranty provided by Lifetime, not a third party. If the support staff can't solve your problem over the phone, they'll tell you how to ship the drive back for repairs.

Whether a defective disk drive is repaired or replaced depends on what's wrong with it. Each drive is tested when it comes in, and then a decision is made. You could end up waiting a week before you see your drive again.

You'll also have to pick up the cost of shipping the drive in for repairs, but that gives you some control over how long it's gone. Lifetime will match return shipping with the method you use to get the drive to

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them. So if you want quicker turnaround, ship the drive in via overnight express and you'll get it back the same way.

Lifetime's technical support staff know what they're talking about and how to ask the right questions to get at the root of the problem quickly. Whenever we called, they were never in any rush to get off the phone; they were patient with "dumb" questions and willing to look up any information not at hand. A toll-free support number would be welcome, though.

20-MEGABYTE DRIVE The company's standard 20-megabyte fixed-disk drive package is built around a combination of Seagate's ST225 half-height drive and Western Digital's WD1002A-WX1 half-length controller card. Add in the excellent installation manual, the fact that the drive comes already low-level-formatted, and the \$335 delivered price, and you've got a bargain that's perfect for the first-

time installer and others more interested in using the fixed disk than fussing with it. (The company also sells the Seagate ST225 without the controller for only \$269, delivered.)

Physically setting up and installing the drive in your PC is a snap; the clear, concise manual makes sure of this. It has illustrations where words alone are insufficient. Although the manual covers installation of the drive with four different Western Digital controllers, the illustrations help you figure out which one you're installing. The manual both tells and shows the correct way to hook up the data and control cables; it also covers which slot is likely to be the best one to plug the controller into. Well-placed reminders tell you to double-check for common errors as you go along.

The drive comes already configured as drive 1, so if it's your only drive, you won't have to make any changes before

you slip it into your PC. If you're installing it as a second drive, follow the instructions on how to find and change the jumper on the rear edge of the drive's circuit board.

■ **Lifetime's technical support staff know how to ask the right questions to get at the root of the problem quickly.**

If you're installing your Lifetime drive into a full-height opening, the package provides a half-height filler plate that snaps into place above the drive's half-height faceplate. That makes adding another half-



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■ MAIL-ORDER HARD DISKS

size device—say a tape backup system—easy.

In all you won't need more than 10 minutes to install the drive itself. In fact, if you're running DOS 3.2, you're finished at this point. Just turn on your machine and transfer the system to the fixed disk. It's already been low-level-formatted, partitioned, and high-level-formatted.

For DOS 3.0 and 3.1, just repartition with FDISK and run FORMAT. For DOS 2.0 and 2.1, you'll have to modify your FORMAT.COM program with DEBUG to get the drive to work correctly above 10 megabytes and check for errors above 16 megabytes. But the procedure is fast and easy. The manual also covers other, specialized installations well, such as installing the drive in an early model PC-1. Including repartitioning and using DEBUG, all the other things you must do after slipping the drive into the PC take no more than 15 to 20 minutes.

Unlike most documentation for this type of hardware, the manual even has a

complete troubleshooting and diagnostics section. But the manual doesn't cover the *Fixed Disk Utilities Software*, except for its use with the PC-1. You'll want to check out the disk itself, which includes a useful program for parking the disk head.

Lifetime includes a \$60 bonus with the package in the form of a copy of Westlake Data's *PC-Fullback* disk backup software, roughly a \$60 value. *PC-Fullback* backs up data fast and would be well worth buying separately.

30-MEGABYTE DRIVE Lifetime's 30-megabyte package for the AT is another winner. Not only has the company shattered the \$500 price barrier, they've also done away with most of the hassle involved in getting the drive up and running.

The 30-megabyte package is built around the standard full-height Seagate ST4038. Lifetime has matched the drive with an excellent general-purpose manual. Even the data cable looks better than the usual kind provided with these drives.

The 70-some-page user manual is written generically to cover installation of a wide range of Seagate's drives in ATs. First, you have to check the jumpers and physically install the drive. Then you slide the drive into your AT's fixed-disk-drive bay and run the installation program. You input the ST4038's drive type, clearly identified in a table in the manual. Then, if you're running DOS 3.2, just transfer your system to your fixed-disk drive and you're up and running. This version of the ST4038 comes already low-level-formatted, partitioned, and high-level-formatted for DOS 3.2.

If you're running DOS 3.0 or 3.1, all you have to do after running SETUP is run FDISK to partition the drive and then FORMAT and transfer your system. In either case, installation won't take you more than 10 to 15 minutes, even if you're a slow reader.

If you're installing Lifetime's Seagate ST4038 as a second drive, the manual does a good job of covering that procedure. It clearly explains the correct position for the drive select jumper and which connector on the AT's daisy-chain controller cable to plug the drive into. There are also easy-to-follow instructions to use if you want to set up more than one partition or include more

than one operating system on the disk drive. The manual also features an excellent troubleshooting guide and checklist that makes diagnosing and fixing most common problems or mistakes a snap.

Once it's running, Lifetime's Seagate ST4038 runs quietly and gives good yeoman performance. Its speed, comfortably within the AT-standard 40-millisecond seek rate range, is pretty much the same as the other AT-class packages that we reviewed (all with the same drive).

Lifetime throws in a valuable freebie with this package, the *PC-Fullback* hard-disk backup utilities software.

Overall, Lifetime Memory Products looks like one of the better mail-order sources for fixed disks. You not only get good hardware, you also get your money's worth in terms of warranty, technical support, and good treatment from the sales staff.

■ ■ ■ ■ PC Connection

Everyone in the personal computer industry promises support. PC Connection (in Marlow, New Hampshire) seems to be serious about it.

First of all, the company makes it easy to get in touch. Both the order and the technical support numbers are toll-free, and they're available from 9 A.M. to 9 P.M. EST weekdays and from 9 A.M. to 5:30 P.M. Saturday.

The sales staff has definitely gotten the word that it's okay to answer everything you ask. They'll make sure you get the information you need. Each time we called, the salespeople were willing to look up technical information and even check what was in the box.

The prices quoted don't include shipping. That's quoted at a hefty 2 percent of the cost of the fixed disk. For the 30-megabyte AT package, that's almost \$12—about double what UPS says it would cost to send a package of the same weight from New York to Los Angeles.

PC Connection customers responding to *PC Magazine's* mail-order survey indicate that your purchase is likely to arrive on time. The company appears to get orders out within a day of purchase.

The standard-performance fixed disks



FACT FILE

Lifetime Memory Products

12611 Research Blvd., #400
Austin, TX 78759
(800) 433-3901
(512) 335-8394

Seagate ST225

List Price: \$335; without Western Digital WD1002A-WX1 controller, \$269
Requires: DOS 2.0 or later.

Capacity: 20 Mbytes.

Size: 5 1/4-inch half-height.

In Short: For one low price, Lifetime gives you everything: a quality 20-Mbyte fixed disk for the XT, with help from friendly salespeople and a knowledgeable technical support staff.

Seagate ST4038

List Price: \$485

Requires: DOS 2.0 or later.

Capacity: 30 Mbytes.

Size: 5 1/4-inch full-height.

In Short: Lifetime didn't stint on quality or concern for the user when putting this package together. For the price, this is the best standard 30-Mbyte AT-class fixed-disk package available.

CIRCLE 688 ON READER SERVICE CARD

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CHOICE

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CIRCLE 238 ON READER SERVICE CARD

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■ MAIL-ORDER HARD DISKS

offered are the same ones available from most of the other companies in this review. They're priced at both ends of the scale. The XT package is among the cheapest, the AT at the high end.

It's what comes with the packages that shows PC Connection is trying to make your life as easy as possible. To begin with, if you've chosen the wrong fixed disk, you have an out. During the 120-day PC Connection warranty period, you can trade up to a different drive. This isn't a money-back guarantee, and you won't get a refund. But you do get a full credit toward the new drive when you return the old one. Just make sure you haven't filled out any warranty cards.

After 120 days, Seagate's factory warranty takes over. Unlike most factory warranties available with mail-order purchases, this one takes effect on the day you buy the drive.

The company handles both warranties itself, as direct-replacement warranties. If something goes wrong with your fixed disk and it can't be fixed over the phone,

the company ships out a new one immediately, even before you've had UPS pick up yours. And your shipping costs can be refunded.

For additional help, the company provides free videotapes demonstrating installation. The first covers the XT drives only, but more are on the way.

20-MEGABYTE DRIVE PC Connection has gone out of its way to make sure you get everything you want in a 20-megabyte fixed-disk package for the XT: low cost (\$299), easy installation, a good warranty, and helpful technical support. The package is made up of Seagate's ST225 20-megabyte drive, Western Digital's WD1002A-WX1 controller, cables, and all the instructions you'll need.

The main source of installation directions, a two-sided instruction sheet, provides a no-nonsense guide to getting the drive into your PC and running. Besides the basic information, you'll find clear explanations of common stumbling blocks for first-time installers.

Physically installing the fixed disk starts with making sure that both the controller and the drive are properly configured. If this is your only drive, you won't have to do anything since the controller jumpers and the drive's jumpers come already set up for drive 1. If this is your second drive, the instructions show clearly which jumpers to move.

Then it's a matter of replacing your B: floppy disk drive, connecting the cables, and plugging the controller into one of the empty slots. Follow the instructions and that process won't take more than 5 minutes.

Once you've got your controller and fixed disk in your PC, you'll have to low-level-format the drive. That's done by using the DEBUG program on your DOS utilities diskette to access the controller's ROM BIOS. Then just follow the prompts and answer the questions.

The instructions tell you to answer no when you're asked if you want to format the disk dynamically. In most cases that's the right way to go, but experienced users might feel better if they input any bad-track information from Seagate's factory test sheet. Follow the steps on the back of the instruction sheet, and you won't have

any trouble. Either way, low-level formatting won't take more than 10 minutes.

Then partition and format your drive with FDISK and FORMAT. That takes another 5 minutes, and you're done.

Neither the video nor the instruction sheet will cover every installation situation. That's why you get a clear invitation to call the toll-free technical support number. You'll probably need to if you're installing this unit as drive 2. Talk to these people; they know their stuff, and they'll have you up and running in no time.

If you're in the market for a second drive, or if you just need to replace one that's worn out, you can order the ST225 without the controller for only \$229. Then call PC Connection for instructions on how to connect it to your existing controller.

You'll find the fixed-disk package to be the solid, quiet-running, XT-class drive you expected to get. It runs in the 80-millisecond seek rate range that is standard for XTs. The other XT fixed disks reviewed run at the same rate.

At its price, this package is one of the lowest-priced 20-megabyte fixed drives available. The hardware is identical to what you pay more for at Lifetime Memory Products and Priority I Electronics, and you get a lot more support. If this is your first drive, or you're just a klutz when it comes to installing anything, buy from PC Connection.

30-MEGABYTE DRIVE In putting together its 30-megabyte fixed-disk package for the AT, PC Connection went the extra step to make installation easy. The package is built around Everex's version of Seagate's ST4038 full-height, 5¼-inch drive; it includes a data cable, Seagate's installation manual, and a PC Connection instruction sheet.

You'll need both sets of instructions to do it right. Read the Seagate manual for the physical installation. It provides great illustrations showing how to set the drive select jumpers and which connector on the controller cable is the right one to use for your configuration.

PC Connection's instruction sheet includes some physical installation instructions that don't appear to apply to most ATs, but the rest of the information makes finishing installation a breeze. The entire



FACT FILE

PC Connection

6 Mill St.
Marlow, NH 03456
(800) 243-8088
(603) 446-3383

Seagate ST225

List Price: \$299; without
Western Digital WD1002A-WX1
controller, \$229.

Requires: DOS 2.0 or later

Capacity: 20 Mbytes.

Size: 5¼-inch half-height.

In Short: If you've never installed one before, this XT-class fixed disk is the one to order; you'll save money, and there's no way you can botch the setup.

CIRCLE 68 ON READER SERVICE CARD

Seagate ST4038

List Price: \$367

Requires: DOS 2.0 or later.

Capacity: 30 Mbytes.

Size: 5¼-inch full-height.

In Short: When you figure in how easy this disk is to install, and the kind of warranty and technical support backing it up, it's amazing how cheap the package really is.

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See Us At COMDEX, Booth # 1916

HOW TO INSTALL A HARD DISK

When you purchase a hard disk via mail order, you'll have to install it without much hand-holding from the vendor. So to help you out, we've included step-by-step instructions for installing one of the most common hard disk/controller combinations: the Seagate ST225 with a Western Digital WD1002-WX1 controller. We chose an XT for this example because nearly half of the respondents to our survey ordered a hard disk for that class of machine. If you have a PC, the same instructions also apply.

Since ATs come with a hard disk drive, people purchase hard disk drives for their ATs as replacement drives or to gain greater capacity. The general steps for installing a hard disk drive into an AT class of machine are similar to those we'll describe here. But the AT does not require a separate controller card. You will need special mounting rails, and the location of the hard disk is different.

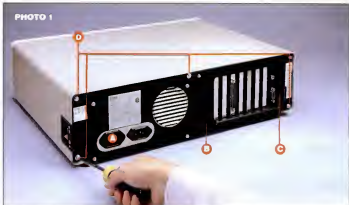


PHOTO 1
Before you begin, turn off your computer and unplug the (A) power cord, (B) keyboard connector, (C) video connector, and any other cables that may be attached to the rear of the unit. Since some of these cables may be screwed into the connectors with very small screws, you'll want to have a small screwdriver handy. Next, remove the (D) five screws that fasten the XT's cover.

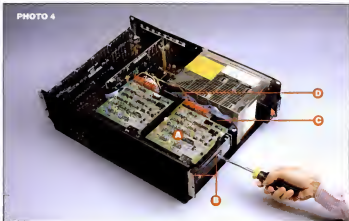
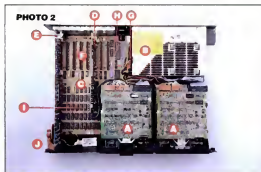


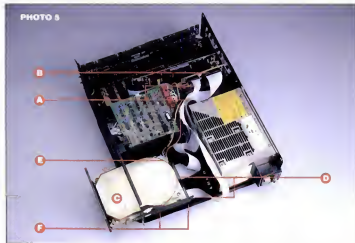
PHOTO 4
You now remove (A) floppy disk drive B. Remove the two screws attached to the drive (see B). Then pull the drive out a few inches to expose the (C) black floppy disk drive connector cable located behind the drive. Slide the connector off carefully and place it neatly under the remaining floppy disk drive. On the rear of the drive to the left-hand side, you'll find some brown connectors. Look under the brown connectors to locate a (D) white connector attached with four separate strands of wire. This is the power cable, which you'll want to remove carefully and leave aside. You'll need this cable later to install the hard disk drive.



Inside the XT you'll find (A) two floppy disk drives, (B) the power supply, (C) the motherboard, (D) the floppy disk drive interface board, (E) the video adapter board, (F) empty expansion slots, (G) DIP switches, (H) the processor chip, (I) RAM chips, and (J) the speaker.



The hard disk kit contains (A) the hard disk itself, (B) the controller card, and (C) cables. The kit also contains two different faceplates for the drive: one is half-height, like the drive; the other is twice the height. In the photo, you can see the latter (D).



The stage is now set for you to install the hard disk. First you'll want to connect the included cables to the controller card. You can't go wrong here. On the hard disk drive, you'll find two sets of connectors—and you can plug in the cables only one way. Notice that on one side of the cable is a stripe, which could be red, blue, or some other color (see A). This

indicates that it connects to pin 1. If you look closely at the pins on the side of the controller card you'll notice a number 1. Just line up the cable with the pins and plug them in.

Next, install the controller card in the slot closest to the floppy disk drive (see B). Snake the attached cables between the floppy drive and the power supply and tuck them in.

To insert the hard disk itself, place the disk in the slot from which you removed the floppy disk drive (see C). But don't push it all the way in. First find the two sets of connectors, which look like gold piano keys, on the bottom rear of the hard disk drive (see D). Notice that the connectors are different lengths and that a small slot is cut out on one side of each connector. These features mean you can't go wrong installing the cables running from the controller since each one fits into only one connector.

Now you'll want to connect the power cable that you removed from the floppy disk drive with location E. Again, the two ends are keyed to fit only one way.

Slide the hard disk all the way in and, using the two screws that you removed from the side of the unit to remove the floppy disk drive, secure the hard disk drive (see F). You've just completed the physical part of the installation process.

To complete the installation, you'll have to install DOS on your hard disk drive. Boot up the computer with your DOS disk in drive A:; Running **FDISK.COM** creates a DOS partition that allows you to install DOS. To format the drive and actually install DOS, type **FORMAT C: /S**—Frank Mitard

Frank Mitard is a PC Labs project leader.

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Microbuffer Mini (parallel print buffer w/28k) ...	79.
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1200 Baud External Modem ...	109.
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Princeton Graphics ... 1 year	
MAX-12E Amber monochrome monitor ...	139.
HX-12E (EGA compatible) ...	499.

Quadram ... 1 year	
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10 Meg cartridge ...	59.
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ScribeCard 30 Meg (68 ms) ...	479.
Mountain Computer ... 1 year	
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40 Meg External Tape Drive (XT or AT) ...	499.
40 Meg External Tape Drive w/Power Supply (XT or AT) ...	569.
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AT 360k Drive (5 1/4" half-height) ...	117.
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Fuji MD2HD (10 disks per box) ...	22.
Sony (10 disks per box) ...	23.
Maxell MD2-HDM (10 disks per box) ...	23.
Verbatim DataLife (10 disks per box) ...	22.
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Sony (10 disks per box) ...	19.
Maxell (10 disks per box) ...	20.
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CompuServe Information Service ...	24.
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■ MAIL-ORDER HARD DISKS

installation takes about 15 or 20 minutes from the time you open the box.

If this is your only drive, you won't have to make any changes to the factory settings. It comes set up as drive 1. Once the cables are hooked up, turn on your PC and run the SETUP routine. You'll find the drive type number clearly identified in the Seagate manual. After that, all you have to do is run FDISK to partition the drive and format it and then transfer your operating system. PC Connection has taken the trouble to provide the drive already low-level-formatted.

If you're installing the Everex/Seagate ST4038 as a second drive, you'll have to delve deeper into Seagate's manual. Better

■ PC Connection's no-wait direct-replacement warranty means you don't have to worry about being without your hard disk.

yet, take advantage of PC Connection's invitation and call the toll-free technical support number. The technical support staff will talk you through the process in half the time it would take you to read the manual.

At \$567 plus shipping, this is one of the more expensive AT-drive packages reviewed. For that money you're not getting any additional performance. The drive runs at the same 40-millisecond seek rate as the other packages' fixed disks. What you are getting is a lot of backup from PC Connection. And if you depend on your hard disk for more than just storing the latest games, PC Connection's direct-replacement warranty means you don't have to worry about being without it.

PC Connections is a good choice if you really don't want to be inconvenienced by your purchase. Buying is easy, and you're well covered if what you bought doesn't suit you. The extra attention to the needs of first-time installers is a plus, and that no-wait direct-replacement warranty could be a lifesaver.

PC Designs

Three-year-old PC Designs (in Broken Arrow, Oklahoma) differs from the other companies in this review in that its main business is selling complete PC clone systems through the mail. It offers add-ons and peripherals as a service to its customers and as a source of additional profit.

That shouldn't stop you from checking them out. The company is easy to deal with and offers a wide range of products.

To make an order, though, you'll have to pay for the call. If you're just trying to get some questions answered, try calling the 800 technical service number. The technicians don't have anything against answering sales questions; they're a pretty friendly lot.

The folks manning the sales desk are pretty good, too. They're perfectly willing to answer your questions and to look up any information they don't have right at hand. They also require less prompting to give you all the details than other companies' sales reps do.

The prices for standard XT and AT fixed disks are in the high range. But the quoted price is the delivered price; no shipping charge is tacked on. Be prepared for a difference between the price advertised and what you pay if you're using your credit card: all MasterCard and Visa purchases cost an extra 2 percent, covering half of the fee PC Designs pays the bank on every credit-card sale. Figure on an extra \$7 for the 20-megabyte drive or an extra \$12 for the 30-megabyte drive.

You can avoid any extra cost by sending in a corporate or personal check. Just plan on shipping being delayed until a personal check clears.

The sales folk do give you a clear idea of what the total amount of your purchase will be—including surcharge and special shipping costs, if any—before they close the sale.

Shipping appears to be within one day of the order, so you won't have an extended wait before your fixed disk arrives. If you need it faster than you can get it by standard UPS shipment, you'll get it faster—if you pay extra.

Before you order, make sure you know what you want. PC Designs doesn't offer a

money-back guarantee nor any sort of trade-up policy. Returns are strictly for defective products.

The warranty policy backing up the standard fixed-disk offerings needs improvement. What you get is a miscellaneous collection of warranties that may or may not be in effect. First there's PC Designs' own 90-day direct-replacement coverage. After that, you have to rely on Everex's 1-year limited warranty on what that company adds to the package, and finally you get whatever is left of Seagate's 1-year warranty to the original purchaser. If you've recently purchased a PC Designs system, the company's warranty on the disk drives will be extended to 1 year, but you have to make the request.

If you do have a problem while your fixed disk is covered by any of those warranties, you won't be left hanging. PC Designs handles all warranty service with direct replacement. First call the technical service number to try to get the problem solved over the phone. If nothing can be done, you'll be told how to go about returning your drive. When your drive arrives at the warehouse in Oklahoma, PC Designs will send you a new one.



FACT FILE

PC Designs

2500 N. Hemlock Circle
Broken Arrow, OK 74012
(918) 251-5550

Seagate ST225

List Price: \$305; without Everex EV391 controller, \$230.

Requires: DOS 2.0 or later.

Capacity: 20 Mbytes.

Size: 5¼-inch half-height.

In Short: The drive performs well, but the low-level format is inexcusable. Only the very patient should consider this package.

Circle 6 on Reader Service Card

Seagate ST4038

List Price: \$529

Requires: DOS 2.0 or later.

Capacity: 30 Mbytes.

Size: 5¼-inch full-height.

In Short: The 2 percent surcharge on credit-card purchases makes this average AT workhorse a little too expensive for its class.

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■ MAIL-ORDER HARD DISKS

If you can't wait a week or so for the round trip, the company is willing to do some fancy bookkeeping with your credit-card account. Order a new fixed-disk drive, and when your old one arrives your account will be credited for the full amount.

You have to swallow the cost of shipping your defective drive to the warehouse, but PC Designs will pay for sending the replacement drive at UPS surface rate.

20-MEGABYTE DRIVE The difference between PC Designs' 20-megabyte XT fixed-disk package and the others reviewed is in the controller. For \$305 PC

■ PC Designs' sales representatives are perfectly willing to answer questions and to look up any information they don't have right at hand.

Designs offers Everex's package made up of Seagate's ubiquitous ST225 half-height, 5¼-inch drive and the Everex EV391 full-length controller, a somewhat modified version of the Western Digital WX1 supplied with the other drives. You also get data and control cables, a fixed-disk-drive utilities software diskette, and a pretty good manual.

The drive and controller arrive already configured for drive 1, so if this is going to be your only fixed disk, you won't have to change any jumpers. If you have another drive number in mind, the clearly illustrated manual shows exactly what to change.

But the manual leaves out any instructions on how to mount the drive in your PC. This omission could cause problems for first-time installers, so keep the technical support number handy.

The next step is to low-level-format the drive. The manual tells you to use the FMTDRIVE program on the utilities disk-

ette, but the program is a disaster. A normal low-level format takes 3 to 3½ hours. If you follow the manual's suggestion to include a read and write check in the format, you'll double or triple the time and blow a whole day. Surely Everex can come up with something better.

One other problem with FMTDRIVE is that it doesn't provide any indication on your monitor that anything is going on. Since the manual doesn't tell you just how long this procedure is going to take, you could easily assume that something went wrong and abort the routine in the middle.

When you wake up from your 3-hour nap, you still have to partition the drive with FDISK and then run FORMAT. That adds 15 minutes to the job.

The user manual does a good job of explaining how to install a second fixed disk. If that's what you have in mind, PC Designs has the ST225 available without the controller for only \$230.

Perhaps that slow format makes a difference. The drive tested out as running in the 70-millisecond seek rate range. That's a bit faster than the same drive from the other companies reviewed.

The ungainly low-level format hurts this fixed-disk package. You may be gaining a few milliseconds in performance, but is it worthwhile? Maybe if the price were lower.

30-MEGABYTE DRIVE The company's entry in the standard-performance fixed-disk category for the AT is Everex's 30-megabyte package. The package consists of a Seagate ST4038 full-height, 5¼-inch disk drive, a data cable, fixed-disk utilities software, and a good user manual.

The drive arrives ready for installation. The side rails are attached, and the drive number select jumper is set for drive 1. Physically installing the drive in your AT is simple. Just slide the drive into the fixed-disk bay and connect the cables.

For low-level formatting, you use the Everex utilities software, which takes most of the pain out of the process. Just put the diskette in drive A:, type FMTDRIVE, and answer the prompts as they appear.

You'll have to input bad-track information from the Seagate factory test sheet that comes with the drive, and you'll have to decide on the interleave factor. For effi-

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Glenn Hart, PC Magazine
May 12, 1987, Page 36.

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William G. Harrington,
The National Law Journal
June 29, 1987, Page 14.

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■ MAIL-ORDER HARD DISKS

cient operation, a fixed drive needs to skip sectors when it's recording and reading data. That way the AT can finish processing data in the first sector before it gets hit with more.

The Everex interleave default is 4, which is great if you have a tape backup system connected to the AT. Otherwise, change it to 3 or 2 for faster retrieval.

Low-level format takes about half an hour. Follow it with the AT's SETUP routine. The manual provides you with the correct drive type number to input. The final 10 minutes of installation are spent running FDISK and FORMAT.

This installation procedure is one of the more complicated among the AT-class drives reviewed. But the manual does a good job of leading you through it.

The manual is written well enough that experienced users can consult it for specialized information such as installing a second fixed disk or installing more than one operating system. The manual will guide you through those procedures, step by step, without insulting your intelligence. For the mistake-prone, the manual includes an excellent troubleshooting

most things about this package are average, including the price. A better warranty policy would improve it greatly.

Overall, PC Designs is a middle-of-the-road source of add-ons for your PC. Neither the prices nor the service is going to overwhelm you.

■ ■ ■ ■ Priority 1 Electronics

The really nice thing about Priority 1 Electronics is that this Chatsworth, California, mail-order supplier of PC peripherals is willing to take the trouble to let you assure yourself of getting exactly what you need.

You get that message as soon as you dial the toll-free 800 order line. Ordering hours are California business hours: 7 A.M. to 5 P.M. on weekdays and 10 A.M. to 5 P.M. Saturday. So you won't have any trouble getting in touch, no matter where you live.

The salespeople treat you like a real customer. For example, they ask permission before your call is put on hold, and they're willing to give you all the information you need, even during busy hours. As with all the other mail-order companies reviewed, you have to ask specific questions if you want to get full information on what you're buying.

Priority 1's prices on standard-performance XT- and AT-class fixed disks are on the high end. You'll also have to figure in the cost of shipping the disk—say, an extra \$5 to \$10.

For your money you get good hardware, decent service, and a degree of security. The service begins immediately after you put in your order. On credit-card sales, your drive will be shipped out on the same day. And if you're in a bind, you can request a delivery method faster than the usual UPS surface shipment.

The security is in the form of a 7-day money-back guarantee and a good warranty policy. The guarantee is simple: you have 7 days from the day that your purchase arrives to decide whether it's what you really want.

Install it. Test it. Dump every bit of software you've got into it. Any reason—from poor performance to not liking the color of the faceplate—is a valid one if you decide to return it for a refund. You

will have to swallow shipping costs, though. That's a small penalty to pay to avoid a possible mistake.

One word of warning: make sure you keep the original packaging, and don't fill out and send in the warranty cards until you're absolutely sure that you're keeping the disk drive. Otherwise you'll complicate the return procedure.

Which warranty you get depends on which drive package you buy. The 20-megabyte XT package is covered by a 1-year direct-replacement warranty. The 30-megabyte AT package is covered only for 90 days by Priority 1, and by Seagate for whatever time remains on the manufacturer's warranty.

If something goes wrong during either warranty period and it can't be fixed over the phone, just send in the drive. Priority 1 will send you a new unit as soon as your old one arrives in California. You don't even have to pay freight charges when you return a defective drive. To take advantage of that generous offer, request either prepayment or reimbursement when you get your return authorization.

Chances are you won't have to send your problematic fixed disk in. Priority 1's

■ The Everex package's interleave default is 4, great if you have a tape backup system connected to your AT. Otherwise change it to 3 or 2 for faster retrieval.

guide and checklist—perfect for those late-night installation sessions when there's no one to call for help.

The only possible point of confusion with this manual is that it's generic for Seagate drives. Make sure you're following the right set of instructions.

Once operating, the drive is an average AT-class performer with an average seek rate in the 42-millisecond range. In fact,



FACT FILE

Priority 1 Electronics

21622 Plummer St.
Chatsworth, CA 91311
(800) 423-5922

Seagate ST225

List Price: \$329; without Western Digital WD1002A-WX1 controller, \$299.

Requires: DOS 2.0 or later.

Capacity: 20 Mbytes.

Size: 5 1/4-inch half-height.

In Short: Priority 1's support and warranties look good, but the lack of a decent installation manual ruins this package.

CIRCLE 654 ON READER SERVICE CARD

Seagate ST4038

List Price: \$599

Requires: DOS 2.0 or later.

Capacity: 30 Mbytes.

Size: 5 1/4-inch half-height.

In Short: A bit pricey, but still a good package. Its performance is equivalent to others in its class.

CIRCLE 655 ON READER SERVICE CARD



EDITOR'S CHOICE

20-MEGABYTE DRIVES FOR THE XT AND COMPATIBLES:

- PC Connection's Seagate ST225 (with Western Digital WD1002A-WX1 Controller)

The Seagate ST225 is an entry-level drive. Chances are that if you need it, you don't know much about it. Support for the buyer is why PC Connection's Seagate ST225/Western Digital WD1002A-WX1 is the best 20-megabyte XT-class package. The price is low, and the company virtually guarantees that you will install it correctly and quickly.

Our choice is also based on PC Connection's policies of letting customers correct a bad choice of disk drive, and not greatly inconveniencing them if something does go wrong. The company deserves credit for demonstrating that providing support is more than just throwing a manual in the box and maintaining a technical support number.

30-MEGABYTE DRIVES FOR THE AT AND COMPATIBLES:

- Lifetime Memory Products' Seagate ST4038

Lifetime Memory Products' Seagate ST4038 is the best choice. The whole idea of buying through the mail is to get the most for the least. That's exactly what you get with the package Lifetime Memory Products has put together.

The quality of the hardware is high, and it's been made easy to install. You get an "extra" that's actually worth something: a copy of PC-Fullback. And all this costs less than \$500—\$60 less than the closest competing package.

What's more, Lifetime takes most of the risk out of the purchase with a long money-back guarantee and a good 1-year warranty.

technical support people are extremely knowledgeable. They were able to identify and correct a number of common and not-so-common problems we posed for them.

20-MEGABYTE DRIVE The company's standard-performance fixed-disk drive package for the XT is yet another combination of Seagate's ST225 20-megabyte drive and the Western Digital WD1002A-WX1 controller. That, the cables, and a photocopied installation manual are all you get.

The manual is a bit of a problem. It's a generic installation manual from Western Digital controllers. No disk drive information is included, and that means you have only half the information you need to perform the installation.

You can't check to make sure the drive's jumper settings are correct, nor do you have any information on how to get the drive into your computer or the correct orientation for the controller and data cables. The information is easily available from Priority 1's technical support number, but it's the kind of information that should never be left out of any fixed-disk package.

Once your fixed-disk drive is in place, don't expect the rest of the installation to be easy. It should be, but the way the Western Digital manual is set up guarantees that you're going to make mistakes and follow the wrong instructions.

The first thing it instructs you to do is to make sure the controller's jumpers are set for your installation requirements. That means consulting a confusing chart at the back of the manual and a line drawing of the controller. Unless you've done this before, nothing on the chart is going to make sense.

Don't worry. If this fixed disk is the only one in your system, both drive and controller will have come properly configured. Otherwise, it's technical-support-number time again.

The next step in the instructions is to initialize (low-level-format) the drive. That's the usual procedure of using DEBUG to get at the controller's ROM BIOS and then answering the questions. You won't have any trouble following the manual's instructions for the first steps, but then the confusion begins.

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■ MAIL-ORDER HARD DISKS

You are given four separate sets of instructions, each for a different BIOS. But you're not told how to identify which BIOS you have. The manual should give you a list of chip numbers so that you can compare them with the chip numbers on the controller and find out which instructions to use. If you make the wrong choice, you could find yourself wasting a lot of time trying to input information you don't have.

Since it was too late to call Priority 1 for help at that point, we completed the initialization by comparing the prompts on the monitor to the various sets of instructions until a match was made. That got the job done in less than 20 minutes. The next step was to run FDISK to partition the drive and then FORMAT.

You don't really get much for the package's price (\$329). You can get the same hardware elsewhere for less, with better instructions.

Priority 1 does offer the ST225 without the controller in case you're looking for a second drive or want to replace an ailing one. But even that version is fairly high-priced (\$299).

30-MEGABYTE DRIVE The standard-performance fixed-disk package that Priority 1 sells for the AT, like the comparable products from the other vendors, is built on the Seagate ST4038. You get a Seagate product manual, but it's useful only to original equipment manufacturers and system integrators. If you have any trouble with installation, you can call Priority 1's technical support line.

The drive performs at the same 40-millisecond seek rate as the other 30-megabyte drives we reviewed.

Priority 1's 30-megabyte package is a good deal, despite the relatively high price. Priority 1's money-back guarantee and direct-replacement warranty can relieve some of your worries, and although you probably won't find a great bargain at Priority 1, you will find a fairly high level of support and backup. These commodities can be worth paying for, particularly if you depend on your fixed disk in making your living.

Walt Rowinsky is a free-lance technical writer based in Cleveland, Ohio.

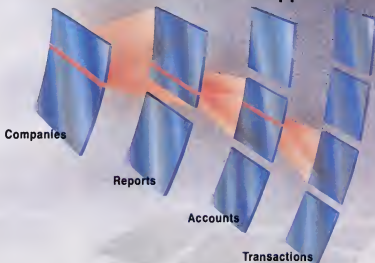
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PC MAGAZINE ■ DECEMBER 8, 1987

284

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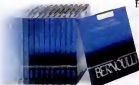
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LATEST WORD

Microsoft Corp.'s \$450 word processor with the succinct moniker *Word* has descended at last from the abstract heights of pure logic into the real world of efficiency and ease. With the introduction of Version 4.0 (a \$75 upgrade to Version 3.1 and available free to post-July 1, 1987, purchasers of 3.1), *Microsoft Word* has not only acquired a slew of new powers, but it has accelerated many of its formerly sluggish functions to jackrabbit speed. *Word* no longer hobbles the keyboard while coddling the mouse. And the addition of lucid new manuals now makes this complex word processing program more accessible to experts and newcomers alike.

Word's newest features include keyboard macros, line drawing, sorting, red lining, line numbers, and document summaries and retrieval, as well as smooth integration with spreadsheets and improved control over page layouts. You can now search and replace formats and styles. And using an existing document as a model, you can now create elaborate style sheets that formerly required a laborious step-by-step process.

Your *Word* documents can now include graphics files created in other programs. The revamped version also includes a generic driver that supports printers using the PostScript page description language.

If you own an early version of *Word*, upgrading to Version 4.0 is virtually a necessity. The new version even includes a utility that removes the hidden files left on your hard disk by *Word*'s long-abandoned copy-protection scheme.

Microsoft Word's latest version has powers that until now Word users had seen only in their dreams. Better yet, it ushers the still-idiosyncratic but less sluggish program into the real world of word processing where life is simpler, speedier, and more flexible.

■ MICROSOFT WORD 4.0

FERVOR—AND CONTEMPT From the time it was introduced in 1983, *Word* has always looked and acted differently from every other word processor on the market. Like other high-end word processors, *Word* offers math, a thesaurus, indexing, outlining, and hyphenation. But, departing from the others, it was designed to be used with a mouse, and it has always made dazzling use of bit-mapped graphics to display italic and other print enhancements.

The program's unique features include the ability to edit two parts of the same file in different windows, and *Word* gives you eight windows to work in. At first, even the screen looked rather unfamiliar: the double-lined border surrounding the text gave early users' energetic mice an exercise maze.

Word speaks its own language, using a vocabulary that has always departed from the familiar vocabulary of word processing. *Word* doesn't use a cursor; it uses a highlight. It doesn't define a block; it selects text. It stores format information in something called a Gallery, and it keeps boilerplate text in a Glossary. With *Word* you don't simply store a file: you first choose a menu where you can transfer it, then you save it, and then you clear it.

```
Path: WORD*.DOC
C:\WORD\README.DOC
C:\WORD\SPACING.DOC
C:\WORD\TESTING.DOC
C:\WORD\TYPES.DOC
C:\WORD\WORD.DOC
C:\WORD\WORD.DOC
```

Query path: WORD*.DOC

author:
operator:
keywords:
creation date: revision date:
document text:
case: Yes(No)
Enter query expression
DOCUMENT-RETRIEVAL

Microsoft Word

Word's new document retrieval screen lets you locate files by using either keywords from summary screens or text in the documents themselves.

Users approached *Word* with either religious fervor or passionate contempt. Many in the glossy computer press treated *Word* as the best thing that ever happened to the PC. They lost credibility in the process because *Word* has been decisively outclassed in the marketplace by *WordPerfect* Corp.'s *WordPerfect*, which offers a simpler interface, greater speed, and generally better capabilities. Many corporate buyers were put off by *Word's* obscure syntax and the prospect of expensive hours of special training. Many writers and academics decided that it was difficult enough to compose a paragraph without wrestling with *Word's* unique vocabulary and concepts at the same time.

CRITICS HEEDED Microsoft gave lip service to answering *Word's* critics by simplifying a few elements in Versions 2 and 3, but it increased the program's complexity in other areas. In creating Version 4.0, *Word's* designers paid more heed to the critics—and undoubtedly to *WordPerfect's* rocketing sales figures as well. In fact, almost everything different and better about *Word* 4.0 stems from Microsoft's intense yearning to knock off *WordPerfect*

as the top-selling word processor and to address the not-unfounded concerns of the business user who felt that *Word* was too slow, too complex, and too heavily dependent on the use of the mouse.

Word's menu structure is as labyrinthine as ever, and its specialized vocabulary is still opaque. But the menus now display explanatory prompts, and the program has hacked numerous shortcuts through the undergrowth.

Sensitive to the still-limited penetration of mice into the corporate arena (something like 90 percent of the corporate users still don't use a mouse), Microsoft now offers better keyboard alternatives. You can now use function keys, as well as the familiar menus, to execute the most common commands. *Word's* new version takes advantage of all 40 states of the F1 through F10 keys, used singly and in combination with the Alt, Shift, and Ctrl keys. As in *WordPerfect*, you can use the function keys to load, save, and print a document, as well as to check spelling and use the thesaurus. And *Word* goes *WordPerfect* one better by letting you redefine the function keys by using macros.

Earlier versions made you use the awk-

PC MAGAZINE FACT FILE



**Microsoft Word,
Version 4.0**
Microsoft Corp.
16011 NE 36th Way
Box 97017
Redmond, WA 98073
(206) 882-9080

List Price: \$450; upgrade from Version 3.1, \$75 (free if you purchased Version 3.1 after July 1, 1987).

Requires: 256K RAM, two disk drives, DOS 2.0 or later.

In Short: A major upgrade of the number-two-selling high-end word processor, Version 4.0 gives you added speed, keyboard macros, red lining, document summaries and retrieval, line numbers, and sorting. Relies less heavily on mice than do previous versions. One of the best programs for driving a multifont laser, but still overly elaborate and idiosyncratic. Not copy protected.

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■ MICROSOFT WORD 4.0

ward and unnecessary Alpha command to return from a menu to a document. Now you can return automatically or by pressing the Esc key. To access many common commands, you used to have to lean on the Tab key (or push the mouse) to make your way through the menus—and Word used to constantly baffle its users by refusing to let them use the cursor keys instead. Now the cursor keys finally act the way you expect them to.

The most welcome enhancement is Word's new speed. It now performs many scrolling and searching operations faster than WordPerfect does, although it doesn't challenge XyWrite's speed record for these and most other functions.

Unfortunately, though, Word is speedy only in its character mode. Its graphics display still slows everything to a crawl. And Word still makes you choose a Print Queue command before it will let you write and print at the same time.

SWITCHING DISPLAYS The program lets you customize the screen to an extent unparalleled in any other program. Before Version 4.0, however, you had to choose whether to use the detailed but painfully slow graphics display or the quick and efficient character display. Now a single key-stroke lets you switch between modes at any time.

If you have an EGA, a Hercules card, a Genius monitor, or a PS/2 system, you can fill the screen with menus, borders, rulers, hidden characters, and format codes, while displaying italics and superscripts in up to 60 lines per screen. If you want a clean, unobtrusive display, you can remove everything, even the borders, and be left with a simple status line at the foot of the screen. WordPerfect's clean screen finally meets an even cleaner rival.

Surprisingly, for all its graphics capabilities, Word still lacks a print preview mode that can display the location of footnotes and headers on the page. An optional "printer display" mode shows where lines will break on the page, but that's all.

The handiest additions to Word's repertoire are its programmable macros. They can be as simple or elaborate as you like, and you can write an AUTOEXEC macro that runs every time you start the program. Word also gives you some helpful simple

WordPerfect Corp.'s WordPerfect, which offers a simpler interface, greater speed, and generally better capabilities. Many corporate buyers were put off by Word's obscure syntax and the prospect of expensive hours of special training. Many writers and academics decided that it was difficult enough to compose a paragraph without wrestling with the MS-DOS/Word's unique vocabulary and concepts at the same time.

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Word's menu structure is as labyrinthine as ever, and its specialized vocabulary is still opaque. But the menus now

display explanatory prompts, and the program has hacked numerous shortcuts through the undergrowth.

B:\NCPAC.TXT

Doc 1 Pg 3 Ln 2 Pos 18

WordPerfect's clean screen (above) has finally met its match with an equally clean rival (below). When you have only one window open, you can remove everything but the status line from the foot of Word's screen.

any time. If you have an EGA, Hercules card, Genius monitor, or any PS/2 system, you can fill the screen with menus, borders, rulers, hidden characters, and format codes, while displaying italics and superscripts in up to sixty lines per screen. But if you want a calm undistracting display, you can remove everything, even the borders, and be left with an unobtrusive status line at the foot of the screen. WordPerfect's clean screen finally meets an even cleaner rival.

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PC B6 Co6

{}

WORD.DOC

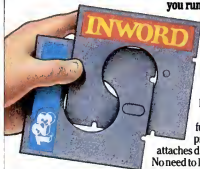
macros that you can use without having to write your own.

Simple macros that you write yourself are similar to those of WordPerfect. To

create one, you switch on a recording key and enter the keystrokes you want to repeat. Then you name the macro and save it in the Glossary.

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*InWord gives you instant spreadsheet integration, plus powerful for-
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Requires 1-2-3 Version 2. Will not run with Version 1 or 1A.

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More-complex macros use a miniature programming language, with commands like IF, ELSE, WHILE, and REPEAT, as well as variables that you can set from the keyboard or directly from any of Word's menus. A few hours of using BASIC is all the programming experience you'll need before sitting down to write an elaborate macro—and the manual is clear enough so that you can puzzle out the system even if you've never programmed before. On the other hand, such complex macros require tedious planning and testing before they pay off in time and convenience. A trace mode lets you step through macros to do the inevitable debugging.

The syntax of Word's macro language is virtually the same syntax that the program's long-standing mail-merge system uses. Word's designers have improved that system also. Complex merges once meant that you wasted a lot of paper and printing time before you made them work as intended. The new version lets you merge to a document that you can edit on-screen before printing.

The primitive speller that was one of Word's weakest elements is gone. The new version, though, has some problems of its own. While it's faster than it was when we reviewed the beta version for our survey of spelling checkers (see "Clonkers and Coolitude: Spelling Checkers Get Better," *PC Magazine*, Volume 6 Number 17), the speller doesn't display your corrections until you return to the normal editing screen. When you encounter a misspelling, you have to press a key to see a list of possible replacements. And some words pose their own problems for the speller. (Users in the legal profession, who will be grateful for the new line-numbering capabilities of Word, may wonder why the speller doesn't recognize *witnesses*.)

ITS OWN STYLE Much of Word is still quirky and idiosyncratic. A superbly designed help system that can access the tutorial directly makes the learning process relatively easy, but Word requires a lot of effort before you feel comfortable using it.

Unlike virtually every other word processor, Word normally expects you to type everything directly into your document and only then decide what to do with it. For example, to create a running header,

WORD'S OTHER "MANUALS"

Finding out everything you ever wanted to know about Microsoft Word can seem as circuitous a process as using its menu system. But Microsoft Press reveals all—for an added price.

If you want to learn everything Microsoft knows about Word, don't expect to find it in the user manuals. Even though the new manuals for Version 4.0 are full of tips and explanations that you couldn't find in the previous manuals, Microsoft still reserves some secrets for its publishing division to reveal.

So after paying the full \$450 or a discounted price for the program, you'll probably find yourself deciding to dig into your pockets again—to pay for two books published by Microsoft Press.

For \$19.95, *Word Processing Power*

with *Microsoft Word*, by Peter Rinearson, will reveal undocumented secrets of Word's hidden text. (A new edition, updated for Word, Version 4.0, will appear in the spring of 1988.)

For \$17.95, *Microsoft Word Style Sheets*, by Peter Rinearson and JoAnne Woodcock, will tell you everything about Word's complex document and print styles.

Why doesn't Microsoft put all the words about Word in the manual? Only its marketing executives know for sure. —Edward Mendelson

you first type the header text into your file and only then define it as a header. If you mistakenly enter the command to create a header while you're working in some ordinary text, the current paragraph will become a header. You'll have to search the manual for the magic formula that turns it back into text.

To incorporate boilerplate text (like the closing of a letter) into a document, you first type the abbreviation (for example, "yrs") into your file and only then press a function key to enlarge the abbreviation into the desired text. To invoke a named macro, you press a function key only after you've typed the macro's name into the text. Not surprisingly, Word documents often end up with stray words and letters that have slipped in while you were attempting to perform a command.

Word handles advanced operations its own way, using its own lingo. When using most word processors, you specify the format of a section of text by inserting format codes at the beginning and other format codes at the end of the section. With Word, you usually select a region of text and then apply formatting to it.

You insert no format codes; instead,

you divide your text into large-scale divisions that can range in size from the entire document to any area that needs special formatting. You put the cursor (sorry, the highlight) in the division that you want to change and go to the Format Division menu. There you choose various format options and apply them to the division. You make similar choices using the Format Paragraph and Format Character menus—not to mention Format Border, Format Running-head, Format Tabs, and Format Revision-marks.

Confusing things still further, Word insists that you use Format Footnote to insert footnotes, but Format Division to determine where to put the footnotes and Gallery Format Paragraph to establish a standard footnote format. You'll need to spend some time using the menus and their options to develop any confidence about which menu choices give you which specific formats.

Word's running headers are equally troublesome because they don't automatically share margin settings with the rest of a document. After defining text as a header, you have to select the text yet again and go to the Format Paragraph menu to speci-

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■ MICROSOFT WORD 4.0



Word Processing Programs: Summary of Features

(Products after Microsoft Word 4.0 listed in alphabetical order)

How Microsoft Word stacks up: Microsoft Word, Version 4.0, competes with the heavy-duty products listed below for the corporate/professional word processing market. Word's features, which include eight windows, mouse support, true document orientation, a spelling checker, and a thesaurus, are a match for any of these products, particularly the number-one-selling WordPerfect; its price is a sliver lower.

	Microsoft Word 4.0 Microsoft Corp.	DisplayWrite 4 IBM Corp.	MultiMate Advantage II Ashton-Tate	Samna Word IV Samna Corp.	WordPerfect 4.2 WordPerfect Corp.	WordStar 2000 Plus MicroPro Int'l. Corp.
List price	\$450	\$495	\$595	\$595	\$495	\$495
Memory consumption	256K	310K	384K	512K	256K	256K
Maximum file length	Unlimited	2.4 Mbytes	128K	Unlimited	Unlimited	Unlimited
USER INTERFACE						
Page-oriented	○	●	●	●	○	○
Document-oriented	●	○	●	●	●	●
Pull-down menus	○	●	●	○	○	○
Windows	8	None	None	2	2	3
FORMATTING						
Style sheets	●	○	○	○	○	●
Font menu	●	○	●	●	●	●
Preview mode	○	○	●	●	●	○
Automatic hyphenation	●	●	●	●	●	●
HARDWARE SUPPORT						
Mouse support	●	●	○	●	○	○
No. of printers	Over 250	IBM-brand printers	Over 400	50	200	Over 250
MISCELLANEOUS						
Exit to DOS/ DOS functions	●	●	●	●	●	●
File import	ASCII, DCA, Excel, Multiplan, 1-2-3	ASCII, Revisable Form Text, Final Form Text, 1-2-3	ASCII, DCA, DIF, NAVYDIF, VCDIF, WPC, WordStar, 1-2-3	ASCII, DCA, DIF	ASCII, DCA, NAVYDIF, Final Form Text, MultiMate 3.22, WordStar 3.3	ASCII, DCA, dBASE, Easy Extra, 1-2-3, Symphony, VP-Planner, WordStar Professional
Draw mode	●	●	●	●	●	●
Macro capability	●	●	●	●	●	●
Math functions	5	4	6	5	4	5
Outliner	●	●	●	●	●	●
Sorting	●	○	●	●	●	●
Spelling checker (no. of words)	130,000	125,000	110,000	80,000	115,000	87,000
Thesaurus (no. of words)	220,000	None	40,000	None	200,000	220,000
Technical support	Free	None	90 days	30 days	Free/toll-free	Free
Copy protected	○	○	○	○	○	○

●—Yes ○—No *In document mode, a repagination command is still required.

fy the margins. If you decide to change the margins in the document, you must change them again in the header.

STYLE SHEETS PAY OFF Word's style sheets enable you to standardize document formats so that you don't have to face the menus every time you start a document. The first time you attempt the uninitiated task of creating a style sheet, though, you'll wonder why you ever purchased Word. However, when you get used to the system, you'll find the style sheets both useful and flexible.

You create a style sheet by laboriously choosing the details of every kind of format from the Gallery menu—from default styles to rarely used ones. You assign each style a key code, usually consisting of two letters. For a paragraph in centered boldface, you might use CB. Then, when you hit Alt-CB in a document, the proper format will appear.

By substituting one style sheet for another, you can alter a document's format. If you switch to a printer that handles italic, you might load a style sheet in which the CB code invokes centered italic. The

codes themselves are somewhat arbitrary; the content of the style sheets determines what they do.

Word lets you format any part of your document as hidden text. Depending on your choice of various menu options, hidden text will or will not appear on-screen or on paper. One style sheet can specify certain text as hidden, while another style sheet can specify it as printable.

Programmers, for example, can use this technique to maintain two different text versions of documentation in a single file. When a programmer prints the shorter

TEACHING WORD A NEW TRICK

Want to print the page the cursor is on—fast? Here's how to take a shortcut and circumvent Microsoft Word's menus via a macro we wrote.

Word's ability to use macros relieves you from using procedures that require long detours from one menu to another. Macros—both the ones the program gives you on disk and the ones you can write yourself—can reduce lengthy procedures to a single key combination.

An especially useful macro is this one, which we've written for you. It's designed to save you the trouble of moving through menus and entering a page number when all you want to do is print the page on which the cursor is located.

```
<<esc>jp&RT page number = field<enter>
<esc>p<tab> f<p>tab>page number<enter>
```

If you insert the macro in your standard Glossary with a name like `print_page`, you can invoke it by pressing Ctrl-P. To enter it in the Glossary, type out the key names (like Esc) and the single angle brackets as ordinary text. Produce the double angle brackets by holding down the Ctrl key while typing

the square bracket keys. For the macro to work, you first must tell Word to divide your document into pages, using the Print Repaginate command.

The macro takes the following route to save you from the time and effort of using the menus. Because Word macros can read values like the page number only in a menu item, not in the status line, the macro goes first to the Jump menu, where it stores the page number in a field called `page number` (or any other name you assign to the field).

The macro then goes to the Print Options menu, where it imitates six strokes of the Tab key. Then it moves to the field that lets you print individual pages, and after that it goes to the field where you enter the numbers of the pages to print. There it inserts the stored number.

Returning to the main Print menu, the macro invokes the Printer command. Before long, the printer produces the page. And all you had to do was hit Ctrl-P.—Edward Mendelson

text that applies to the shareware version of his program, he can use a style sheet that hides the sections that refer only to the commercial version. A different style sheet hides the sections that describe shareware and reveals the rest. Other handy uses of this feature include tailoring a résumé by using hidden and revealed sections of text suited to particular job descriptions or consulting engagements, and including extensive descriptive or explanatory information in a document that, with the information hidden, can also serve as a summary or more concise version.

PRINTING QUIRKS For a program that puts so much emphasis on printed output, Word treats actual pages as a mere afterthought. You have to use the Print Repaginate command to find out the page on

which you're working. Also, the program offers no straightforward way to print the page on which the cursor is located. You have to carefully thread your way through a whole series of menus before you can accomplish this task—which in WordPerfect requires only two keystrokes. At least the new version lets you write a macro that will traverse the menus for you (see sidebar "Teaching Word a New Trick" for an example).

In addition, despite Word's reputation for offering precise control over laser printers, its performance has some rough edges. Even when using the Z cartridge for the HP LaserJet (the so-called "Microsoft" cartridge), you'll have to make some manual adjustments if you don't want to print everything in 10-point type. You can tell Word to set line spacing automatically,

but with 12-point type the results are too densely packed for easy reading.


To get a readable page, you have to specify 14-point line spacing. Doing so requires a lot of menu jumping: you set font size from the Format Character menu, then line spacing from the Format Paragraph menu. XyQuest's XyWrite, in contrast, lets you avoid all this trouble by placing a simple and effective auto-leading command at the start of a file or in the program defaults. But when compared with WordPerfect, Word is miles ahead in its ability to control laser printers.

Word 4.0 gives you an improved DCA conversion utility. If you need to exchange files with formats, you can use the coupon Microsoft includes with Word to order Perfect Exchange, a \$69.95 conversion utility from Systems Compatibility Corp. (Chicago, Ill.). Perfect Exchange converts documents to and from WordStar, Version 4.0, WordPerfect, MultiMate Advantage II, Samna Word, Volkswriter, Wang PC, DEC WPS Plus, DisplayWrite 3, and ASCII formats.

Word's improved version won't lead its strongest competitors to fold up shop. Corporations will still blanch at the training time Word requires, and different sectors in the high-end word processing market will continue to be attracted by WordPerfect's ease of mastery and refreshing directness, XyWrite's speed, printer control, and Atex typesetting interface; and for scholarly and scientific documents, the power and flexibility of Dragonfly Software's Note Bene.

Yet Version 4.0 will add new recruits to Word's loyal cadre of users. Word is ideal for many desktop publishing tasks, especially for preparing documents such as reports, proposals, and manuals that use multiple fonts and require an outline processor to ensure consistency of font style. Computer-literate users who work with similarly complex, standardized formats won't find a product that surpasses Word. And everyone concerned with program design will recognize Word as a daring and original product that will continue to change and challenge the word processing market.

Edward Mendelson is a frequent contributor to PC Magazine.



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Electronic mail (or e-mail) systems help people get on with business by eliminating the frustrating game of telephone tag. Such packages, also known as store-and-forward-message systems, accept and store mail, then forward it when you check in to the system. Despite heavy travel or erratic work hours, you'll never miss a message and can respond whenever you wish.

You can obtain e-mail services by leasing them on an as-used basis from services such as MCI Mail. You can install an e-mail program on a host mini or microcomputer. Or you can use a program hosted on a server in a PC-based local area network.

Each option has its advantages and disadvantages. Leased services require no up-front costs and are very reliable. But such services are

All e-mail systems will help you put an end to the time-wasting game of telephone tag. But if you already have a LAN, *cc:Mail LAN Package* and *Network Courier* offer cost-effective and trouble-free alternatives to other types of e-mail systems.

■ FRANK J. DERFLER, JR.

expensive. MCI's rates, for instance, vary from about \$2 for a 10K-byte file to \$13 for a 100K file. Services installed on a mainframe host can be effective, particularly for companies that already have such systems. But typically an overworked data processing department must install and maintain them.

For applications, such as are used in real estate brokerages, universities, or even large companies in which people send messages primarily to other members of the same organization, using an e-mail program on an existing LAN will provide a relatively cost-effective and trouble-free solution.

LAN-based systems are economical because their supporting hardware is paid for by other network functions. Also, unlike leased services, e-mail functions on a LAN re-

■ LAN E-MAIL PROGRAMS

quire no additional per-use charges. And the network administrator can install and maintain the e-mail system.

Many electronic mail programs are available for local area networks, but most are designed to run with specific networking software. Network operating systems such as Fox's *10-NET*, Novell's *NetWare*, 3Com's *3+Share*, Waterloo Microsystems' *Waterloo Port*, Banyan's *VINES*, and Torus's *Tapestry* all include electronic

■ These programs can use any type of networking media, topology, and software.

mail or offer it as an option. We have included reviews of such e-mail systems in articles that discuss the overall packages, as in our review of Novell's *Advanced NetWare*, in "Making Connections: LANs Under NetWare," *PC Magazine*, Volume 5 Number 21. However, some operating systems, notably IBM's *PC Local Area Network Program*, include no electronic mail structure, and others might not have all the features you want.

This article reviews *cc:Mail LAN Package* and *The Network Courier Inter-NetWork Version*, which are two electronic mail packages that run on a wide variety of local area networks and include only e-mail capabilities. (Other multifunction LAN utility programs, notably Conetic Systems' *Higgins*, include e-mail along with other capabilities.) These programs can run on networks requiring any type of networking media over any type of network topology, and they can use any networking software.

E-MAIL FUNCTIONS Like most other electronic mail programs for PCs, e-mail programs for LANs are designed to address, prepare, transmit, and retrieve messages. In addition, many e-mail systems break down each of these steps into a wide variety of subtasks for added flexibility and capability.

For example, many e-mail systems let you address a message to a single primary addressee, multiple primary addressees, or to a predetermined mailing list. Secondary addressees (cc:) can be selected in the same way.

Unlike many other PC e-mail systems, all systems for LANs allow you to attach program and data files to text messages, in addition to reading in text files. Some packages also allow you to transmit a video screen previously captured from another program or to include other graphic elements in your mail.

In most cases, you will use LAN e-mail systems to send messages to people on the same LAN. However, you can also send messages to "post offices" in other networks through dial-up asynchronous communications ports.

These packages also offer a variety of mail-retrieval options, including filing, forwarding, and replying to the sender or to the sender plus other addressees.

But no matter what features an e-mail package offers, in order for such a package to be truly useful, the system software must be easy to use and must meet the needs of the work group. More so than other software, it must attract a critical mass of users in order for it to become worthwhile for each person to take the time to learn the system. Once these conditions are met, an electronic mail system can become a tool used to smooth communications within a work group and to improve individual and group productivity.

cc:Mail LAN Package

The *cc:Mail LAN Package*, from PCC Systems, meets the necessary requirements for attracting a sizable base of users on the network. It contains many powerful features yet remains easy to use.

cc:Mail's point-and-shoot menu system—which includes a main menu and submenus for message reading, storage, and creation—is what makes this package so easy to use. In fact, the PC Labs testers were able to learn the system effectively and efficiently without reading the manual or coaching.

The package also offers a great many features. For instance, when the network administrator assigns mailboxes, he can



FACT FILE



cc:Mail LAN Package
PCC Systems Inc.
480 California Ave.,
#201
Palo Alto, CA 94306
(415) 321-0430
List Price: \$595

Requires: 320K RAM,
LAN operating system, DOS 3.1 or later.

In Short: An easy-to-use e-mail program that includes a wide range of features. It is unique in its ability to attach snapshots of applications screens to files, allowing you to illustrate your text. However, since it is not memory resident, you must load the program each time you wish to use it. Not copy protected.

CIRCLE 603 ON READER SERVICE CARD

assign individuals their own box under a specific name or several boxes under different names, or he can list them as part of a group sharing a single mailing address.

In addition, the administrator can define as many as 100 files called bulletin boards, on which as many as 500 public messages may be posted. For example, you could create a bulletin board called Pascal Programming on an electronic mail system running under *cc:Mail*.

You can specify files in which individuals can store their mail within the e-mail program. The administrator can also establish up to 100 mailing lists in order to dispatch messages easily to specific groups of people on the network.

If a message is particularly important, the administrator can request that the package automatically generate a receipt when it is read. The receipt is actually a new message that the program sends back to the originator.

If your local area network has dial-in and dial-out capabilities, *cc:Mail* lets you exchange mail with other networks running the same software anywhere in the world. To perform such a transfer, the package knows enough to call over the telephone lines and transfer the message automatically.

USING CC:MAIL *cc:Mail* is not memory resident. As a result, you'll have to go through the rather complex log-on procedure each time you want to check for in-

coming mail. This procedure involves specifying your user name, the drive on which you want to store messages, where to find resources on the network, and the type of monitor you're using. To simplify this process, the network administrator can establish a batch file (see sidebar "A Batch File for Easy E-Mail Log-on") to start the program, so that checking your mail will involve nothing more than typing MAIL from any drive or subdirectory.

Once you're in the program, it provides many time-saving amenities. *cc:Mail*'s screen editor makes it easy for you to create active outgoing messages. This powerful edi-

■ *cc:Mail*'s screen editor makes it easy to create outgoing messages by letting you use the functions of all of the PC's predefined editing keys.

tor allows you to use the functions of all of the PC's predefined editing keys, including the Ins key, the Del key, and Backspace with erase. The editor also provides such features as word wrapping, block moves, and search and replace.

When it's time to send out your message, the program lists the names of every individual on the system in alphabetical order. To select a name, you move the cursor to it and press Enter. Using *cc:Mail*, you'll never have to guess another user's mailbox name.

Any user can create a mailing list and make it available to all other users, so that it is easy to address people with common interests. The person who created the list can add or delete names from it at any time. The system offers a mailing-list menu that tells you the number of mailboxes in each list, and a submenu tells you



LAN E-Mail Programs: Summary of Features

(Products listed in ascending price order)

List price	cc:Mail LAN Package \$595	The Network Courier Inter-Network Version \$995
No. of users	25*	150
No. of mailing lists	100	50
No. of bulletin boards	100	0
Gives notification of mail receipt	<input type="radio"/>	<input checked="" type="radio"/>
Lists names of all system users	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Supplies delivery receipt	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Forwards messages	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Prioritizes mail	<input type="radio"/>	<input checked="" type="radio"/>
Sends messages to other networks	<input checked="" type="radio"/>	<input checked="" type="radio"/>

TEXT AND GRAPHICS

Built-in text editor has:	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Insert mode	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Line wrap	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Erasing Backspace key	<input type="radio"/>	<input checked="" type="radio"/>
Deletes key	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Block delete	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Block move	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Search and replace	<input checked="" type="radio"/>	<input type="radio"/>
Text highlighting	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Margin and tab adjustment	<input checked="" type="radio"/>	<input type="radio"/>
Text file insert option	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Offers built-in graphics editor	<input checked="" type="radio"/>	<input type="radio"/>

FILE ATTACHMENT

Type of data	Text and binary	Text and binary
Screen capture	<input checked="" type="radio"/>	<input type="radio"/>

●—Yes ○—No *The initial \$595 system is limited to 25 users. An expansion package (for an additional \$595) removes any program limits on the number of users.

Instead of addressing messages to specific mailbox names, you could address them to a public bulletin board. In this way, anyone interested in the topic can read all relevant messages.

When you receive an incoming message, you store it in a file that the *cc:Mail* system administrator maintains. The system labels these stored messages with the same sender/subject/date tag that comes on all new incoming messages. This message-handling scheme is better than sending them off to a DOS file whose name you

perspers among many other incoming messages. It is much easier to follow a line of thought and to formulate a reply if you can group the messages according to the originator and date. The *cc:Mail* menu lets you make these choices very easily. You can sort incoming messages for reading or review by a number of criteria, including the date that they were created, a keyword phrase in the Subject line, or the name of the person in the From line.

FILE ATTACHMENT To transfer exist-



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Microcom Networking Protocol™: Why it Became the

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Product Feature	Microcom AX/9624c	Another Major Vendor
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Installed base	>150,000	<1,000
Number of stored phone numbers	9	4
Employs industry standard MNP	yes	no
# of compatible MNP modem vendors	40+	0
Supports CCITT V.29 FT modulation	yes	no
Password Security Option	yes	no
Upgradeable product line	yes	no
Voice/Data Switch	yes	no
Hardware Settable Serial Port Speed	yes	no

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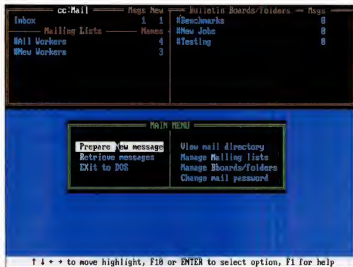
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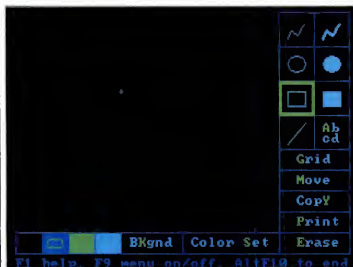
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■ LAN E-MAIL PROGRAMS



In the upper portion of its main menu, cc:Mail LAN Package displays statistics about the system's configuration. The menu in the middle of the page allows the network administrator to create and manage mailboxes, mailing lists, and bulletin boards.



Using cc:Mail LAN Package's graphics program, which looks like a stripped-down version of PC Paintbrush, you create your own drawings to illustrate a text message. After you capture this image using an included screen capture program, you can forward your graphics to a recipient along with your text.

recipient a message describing its location on a shared disk drive. cc:Mail, however, makes it easy for you to attach binary program and data files to any message.

To use the file attachment feature, you simply select the option Attach Copy of DOS File on the message-preparation menu. Choosing this option brings up a prompt asking for the filename and suggesting an initial pathname. You can backspace over the pathname and designate any file on the network for attachment. While you can attach multiple files to a single message, you must attach each one separately. The program asks you to provide the path and name of the file to be attached, but you can't use DOS wildcards.

When you receive a message containing an attached file, cc:Mail displays its name but won't allow you to view the file, since it is likely to contain binary characters. You can save the file under any name on any drive available through DOS.

GRAPHIC MAIL cc:Mail also allows you to create graphic images and attach them to an outgoing message, just as you would binary files. Unlike binary files, however, graphic images must be viewed after you read the message. In other words, it lets you illustrate your words. A menu option lets you jump between the text and graphics files so you can compare the image with its text description.

To create illustrations, you can use the included Snapshot utility that lets you capture images from most PC applications programs. Snapshot is resident in RAM, and you call it by using the Alt and I keys. As with most RAM-resident graphics programs, Snapshot is not compatible with all applications, but it works with most "well-behaved" programs.

cc:Mail also includes a program that looks like a stripped-down version of PC Paintbrush or GEM and allows you to draw your own images. The drawing tools include lines, circles, rectangles, and a single character set. You can display grid lines on the screen to aid in drawing, as well as vary background and foreground colors.

SECURITY cc:Mail offers password security. For additional security, cc:Mail stores the message files in an encoded bi-

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■ LAN E-MAIL PROGRAMS

nary format, so they cannot be read without a significant effort. We tried to look at the files using DEBUG, and it appears that the designers changed the sequence of the bits representing the characters to prevent any but a determined and skilled person from reading message files without permission.

INSTALLATION Installing *cc:Mail* involves simply reading the contents of two 360K-byte floppy disks into a subdirectory on the server's hard disk. Some networking software, such as IBM's *PC Local Area Network Program*, allows any station on the network to contribute resources. In that case, any PC with a hard disk can function as the e-mail server.

After the files have been loaded, the administrator logs on to the mail system by typing his post office name, password, drive designation, and (optionally) color. He can then use the program's menus to create post offices, mailboxes, mailing lists, and bulletin boards.

cc:Mail is divided into three sections: user program files, the program help files, and the management utility program. Each user file occupies less than 8K bytes. The administrator file uses less than 1K byte per user, and the message database is 50 to 100K per user—although it can be larger.

After starting the program, the network administrator must use the facilities of the networking software to designate the files as shareable among all of the users. The network administrator will normally map or link the electronic mail portion of the server's hard disk as a separate disk drive on each user's workstation. In this way, anyone wanting to use electronic mail must simply change to a specific drive designator (traditionally the M: drive) to access the mail files. The administrator can further automate the process by setting up the network's applications menu or a batch file for calling *cc:Mail*.

ADMINISTRATION *cc:Mail* provides a set of utility programs to help the administrator maintain the system. One of the provided utility systems, called *ChkStat*, includes three named subutilities. For programmers who wish to know exactly what *cc:Mail* is doing at all times, *Diagnostics* allows you to examine and correct all

counters and pointers. It also provides information on all messages in the *cc:Mail* database. The second subutility is called *Users*. It lists all users in the system and gives the size of each user's files. This is particularly helpful since an administrator can find the "trash collectors" who never clean up their mailboxes and who use large quantities of space on the hard disk.

The third *ChkStat* subutility, called *Messages*, provides a summary by users or by bulletin boards of the number of stored messages, total number of bytes used, and other statistics that give the administrator an accurate picture of how the system is being used.

Another separate utility program called *Reclaim* reorganizes the database file so that the program can use storage space more efficiently.

DOCUMENTATION The *cc:Mail* documentation is very detailed and is divided into separate books for the administrator and the average user. Each section includes an index and a table of contents. Sample screen displays nicely illustrate the way the system works. However, except for the section on the administrator's utilities and initial installation, most people will probably never need to use the documentation because of the clarity of the user interface.

BOTTOM LINE *cc:Mail* is a practical program for large and small electronic mail systems, as long as you don't mind loading the program each time you want to check your mail. Its limitations are set mainly by the size of the hard disk on the server and the performance of the network. This program can carry the mail effectively, with little or no user training and low administrator work load.

The Network Courier Inter-Network Version

The *Network Courier Inter-Network Version*, from Consumers Software, is a full-featured e-mail package for creating and receiving mail. Unlike *cc:Mail*, *Network Courier* is memory resident. As a result, it has the advantage of allowing you to read, send, or save messages without leaving your applications program.



FACT FILE

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*The Network Courier
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Bellingham, WA 98225
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List Price: \$995; *The Network Courier Six-User Starter Kit*, \$295; *The Network Courier Single Server*, \$695.

Requires: 128K RAM, 60K RAM for memory-resident monitor program (optional), LAN operating system, DOS 3.1 or later.

In Short: A RAM-resident e-mail program for LANs that provides a full range of mail services but is, at times, uninitiative to operate. Not copy protected.

CIRCLE 692 ON READER SERVICE CARD

To operate *Network Courier*, you use a menu system like that in 1-2-3. This menu allows you to read, forward, delete, store, and so forth. The basic screen displays information such as the sender and the subject of incoming mail. The display also includes a 40-character subject line, which you can use as a message in itself, especially since many electronic mail messages are short responses of yes/no, the date, the time, and so forth.

Network Courier provides a full-featured text editor for message creation that includes such features as automatic line wrap, and it works with the PC's Ins and Del keys. While it allows you to perform block moves, it will not do a search and replace.

When you're ready to send out your messages, the program pops up a window listing potential addressees. And you can select more than one of these names at a time to whom to address messages. However, the program asks you to use the Spacebar to select these addressees. Our reviewers found this unintuitive. We usually ended up scrolling to the desired name, pressing Return, and wondering why the name wasn't entered into the message form.

You can also create messages with a priority designation. Priority messages are displayed on the recipient's screen ahead of nonpriority messages.

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A BATCH FILE FOR EASY E-MAIL LOG-ON

Although Network Courier and cc:Mail do not store a user profile for easy log-on to the system, the network administrator can easily write a batch file that will perform that function.

Many programs that run on networks can store a user profile that tells the program everything it needs to know about the user and the terminal, where to find and store files, and so forth. The two products reviewed here, however, do not. You'll therefore have to provide all of this information each time you wish to start the program. In the case of *cc:Mail*, that would mean every time you want to check for mail. For *Network Courier*, that means every time you start up your system.

But the network administrator can make the e-mail sign-on process less onerous to users by constructing a batch file, using either DOS or the network operating system, to start either *cc:Mail* or *Network Courier* for a particular user almost automatically.

In the user's AUTOEXEC.BAT file, you use the DOS environment command SET to give the operating system a name that is passed to other batch files that are called in later. The AUTOEXEC.BAT file contains whatever path, prompt, and other commands the user usually needs. It also contains the line

```
Set USER=ED
```

(or "Sally" or "Frank" or whatever the user's name is).

After the AUTOEXEC.BAT file runs, a batch file called EMAIL.BAT can read the USER parameter from

DOS. The EMAIL.BAT file moves to the appropriate virtual network drive and calls the electronic mail system, whose name is shown here as "mail."

When users want to use the mail program, they type EMAIL on the DOS command line, and the EMAIL.BAT file will start the e-mail program. If you decide to use the menu facility provided in your network operating system to create this batch file instead of using DOS, you can still use the SET feature of DOS and pass the name of the EMAIL.BAT file to DOS from the menu system for execution.

The last line of this batch file starts the mail program and echoes the user's name. It can also designate the disk drive the files are on and specify the use of color, if you wish. (You'll have to provide one batch file for users with color monitors and another for users with monochrome screens.)

```
ECHO OFF
CLS
M:
MAIL %USER% D: <color>
```

The advantage of using a Set command is that the network administrator can give every user an identical batch file named Email. The network administrator doesn't have to customize each batch file with each person's user name.

—Frank J. Derfler, Jr.

A unique feature of the *Network Courier* package is that it will notify you when mail arrives while you work in your application. Moreover, the program lets you choose how it should notify you when mail arrives. The program will either store it in your mailbox without notifying you, or the

speaker will beep to inform you that mail has arrived, or it will beep and flash a message on-screen telling you whom the mail is from.

Network Courier allows people to store messages in either private directories or public directories that are accessible to

anyone on the system, but it does not contain a public bulletin board system like the one found in *cc:Mail*.

You can sort messages according to the date they were received, the sender, the subject, or the mail priority, though you can select only one of these sort of criteria at a time. Unfortunately, you almost have to sort messages with this feature to find anything because *Network Courier* displays only ten lines on the screen at one time. If you have many messages in storage, it would take you a long time to locate a file in a ten-line window.

MESSAGE-HANDLING FEATURES

The message-handling portion of the program allows you to mark sections of a message for special treatment. For instance, you can save a section of an incoming message into a specific file or bring a portion of a message in storage into a message that you are composing. You use the F5 key to bring in the contents of an ASCII text file stored anywhere on the network.

Network Courier's menu system makes it easy to attach files to a text message. In fact, you can send up to ten binary and ASCII files through the network as part of a single electronic mail transmission. The menu system displays the names of all files in any subdirectory, and you simply use the cursor keys and Spacebar to select those you want to attach to the text message.

When you receive a message with attachments, *Network Courier* lets you handle the text file separately from the attached file. You can then either save each under a unique name or delete them.

EXTERNAL MAIL The *Network Courier* external mail program allows you to exchange mail with other networks. To use this program, you boot it in a dedicated network station capable of asynchronous communications and keep it running as long as you want mail exchange to take place.

The network administrator assigns names, telephone numbers, and passwords of the remote post offices into the system. He must also tell the system the hours of operation of other networks, which it then uses to determine when to call those other systems to transfer mail.

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Robotic Hands

Page 1

Recent Robotic Hand Research

Presently, there are two disparate approaches to gripper construction, with correspondingly different design goals. The two types are industrial hands and omni-hands. Industrial hands are fairly simple, uni-function, one or two DOF grippers which are currently being used for such jobs as welding and assembly-type functions. Omni-hands are complex, multiple DOF hands.

Antropomorphic hands are supplemented by sophisticated hardware and feedback control and offer many advantages: a large range of motion and the ability to pick up objects and manipulate delicate parts without causing damage to them. Maintaining a stable grasp, high coon, and complexity of control relegate this hand to the status of a research tool for the present. The complexity of the additional degrees of freedom inherent in the Omni-hand is illustrated in Figure 1.

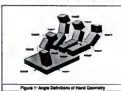
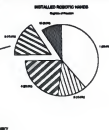


Figure 1: Degree Definitions of Hand Operating

Until exoskeleton work in decision-making, task strategy, and vision systems is developed, the potential of this hand cannot be realized. The decreasing cost of producing a functional hand with more than one degree of freedom is speeding acceptance by industry as illustrated in the following graph.



The cost figures are based on a three fingered hand, each finger supporting three DOFs. Lower acquisition costs will allow an increase in the number of degrees of freedom employed in industrial hands. Placing the control for the hand on the arm so as to reduce the weight on the hand itself also lowers cost. The hand-object system was modified in a rigid body system, in which a heuristic for a stable grasp is a grasp that, when acted by an external force, tends to produce a moment or force to maintain the system as stability.

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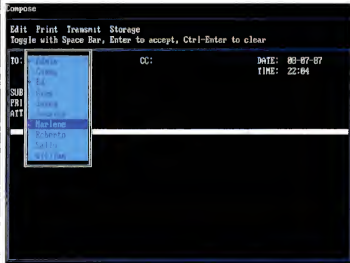
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■ LAN E-MAIL PROGRAMS



Screen windows display selections for many of The Network Courier Inter-Network Version's functions. To send mail, you select names from the mail-creation menu shown above, which lists all users on the system. To send the message to more than one person, you press the Spacebar when the cursor highlights an entry. The names preceded by arrows have been marked for a multiple mailing. The user is about to add a third name, "Marlene," to the list. The process of marking each entry with the Spacebar is not intuitive, but it is quickly learned.

A special Inter-Post Office monitor screen displays messages that describe the activities of the external mail program and that summarize the number of messages sent and received. Some users of automated mail programs such as *Lotus Express* find it frustrating not to know what the program is doing at any specific time. The status screen in *Network Courier* eliminates that frustration.

Through the use of the external mail program, systems across the country or across oceans can pass messages in an automated and timely matter. The economy of this kind of system depends completely on administrative factors, such as the type of communications link used between the networks and the controls over who can send messages to external mailboxes.

SECURITY *Network Courier* uses passwords to limit access to the system. In addition, it stores message files in a binary encoded format. Inspection of the files

with *DEBUG* showed that they are encoded by values added to the ASCII characters. This type of scheme prevents casual inspection of the files and ensures that only a lengthy and skilled attack on the files will provide usable text.

DOCUMENTATION The *Network Courier* manual comes with separate sections for the mail administrator and mail users. The manual includes a detailed tutorial, an index, and a table of contents. I liked the tone and arrangement of the material in the manual but often wished for more depth of information. The explanations are clear, but more examples would be useful.

INSTALLATION *Network Courier* comes with an installation program that is ready to put the system in the network's virtual drive M: (for mail). If you don't want to use drive M:, you have to add extra parameters to the command used to call the installation program. The installation pro-

gram creates a subdirectory called *Courier*, copies all of the needed files, and creates the network database.

We ran into a couple of quirks installing *Network Courier*. The installation program generated a new version of the mail program and created the new *Courier* subdirectory, but it failed to transfer the files to the server's hard disk. Instead, we had to use a *COPY A:*. * ** command to bring the files over. While this isn't hard, it was unexpected.

The situation became even more confusing when we ran the installation program again to see if we had missed a step. When the installation program found that the subdirectory already existed, the error message read "That Drive Doesn't Exist." This error message was more confusing than helpful.

Normally, you load the optional memory-resident monitor program from an *AUTOEXEC.BAT* file. While the monitor program is compatible with such memory-resident programs as *SideKick* and *ProKey*, you must load it into memory last.

MANAGING THE MAIL The network administrator employs tools from the networking software to give users access rights to the network subdirectory that contains the mail package. For instance, the administrator for a network running under Novell's *Advanced NetWare* would use the Syscon menu to grant user rights. For those who use 3Com's *3+Share*, IBM's *PC Local Area Network Program*, or similar network operating systems, you'll need to create a sharename that users can refer to when gaining access through *3+Share*'s 3F Link or *PC LAN's* Net Use commands.

The electronic mail administrator configures the *Network Courier* system by naming the mailboxes and assigning passwords. The administrator can also create groups of mailboxes for mailing lists.

Busy electronic mail systems can take up a great deal of space on the server's hard disk drive. As the system is used, the mail administrator's chores will include deleting mailboxes, compressing them, and carefully monitoring the use of disk storage space. *Network Courier* provides a useful status screen display that indicates the number of users, the number of letters in the system, the number of bytes used for

■ LAN E-MAIL PROGRAMS

certain categories of files, and the amount of remaining disk storage space. The administrator can delete mail according to several criteria, including the date received, whether it has been read, and the name of the recipient.

The administrator can also limit the

■ *Network Courier* is particularly appropriate for processing, shipping, or manufacturing applications where the notification of incoming mail is valuable.

privileges of users, permitting some only to retrieve messages and some to send them. For example, a shipping department might be a receive-only mail station and a receptionist or telephone operator might have send-only privileges.

BOTTOM LINE Though *Network Courier* is at times unintuitive to operate, it is, overall, a competent program that provides complete service to busy electronic mail users. It is particularly appropriate for processing, shipping, or manufacturing applications where the notification of incoming mail is valuable. It works well with a variety of networking programs and could be used instead of programs provided with the networking software.

MAKING A CHOICE Either of these programs will provide excellent electronic mail service both on a single LAN and between LANs. They have a relatively equal mix of features and utilities. But *cc:Mail* has a better user interface and is easier to install, use, and maintain. However, if on-line monitoring of mail is important, then I would choose *Network Courier*. □

Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

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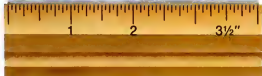
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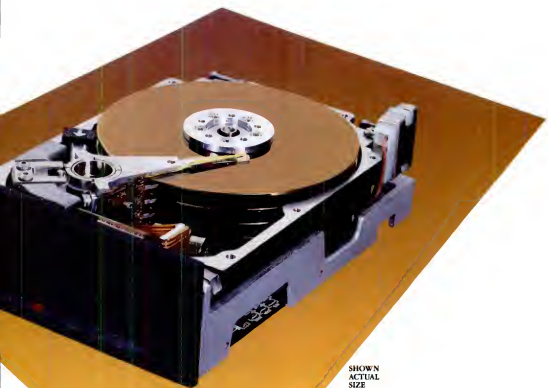
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PACKAGED COMPUTERS FOR NO-PAIN COMPUTING



When the IBM PC first entered the PC market, it brought with it a wealth of new standards. MS/PC-DOS became a standard. The 80xx series Intel microprocessors became a standard.

The 5¼-inch floppy disk became a standard. The CGA color graphics scheme became a standard. IBM expansion slots became a standard. The IBM keyboard and its excellent tactile feedback became a standard. And so too did the look of a desktop computer system.


First-time PC users, small-business owners, and students may find that one of these all-in-one XT systems from Acer, Cordata, IBM, Vendex, or Zenith suits all their computing needs.

■ PACKAGED COMPUTERS



Packaged Computers: Summary of Features

(Products listed in ascending price order)

	 Vendex Turbo-888-XT Vendex Pacific Inc. \$995	Zenith ezYz pc Zenith Data Systems \$999	Cordata WPC Cordata Technologies Inc. \$1,095	Acer 710 Acer Technologies Corp. \$1,195	IBM PS/2 Model 25 IBM Corp. \$1,350
Base price					
BASE PRICE INCLUDES					
RAM	512K	512K	512K	768K	512K
Floppy disk drives	2 5¼-inch	1 3½-inch	2 5¼-inch	2 5¼-inch	1 3½-inch
Monitor	14-inch monochrome	14-inch monochrome	12-inch monochrome	12-inch monochrome	12-inch monochrome
Ports	Parallel, serial, mouse, game, light pen	Parallel, mouse	Parallel, serial, RGB	Parallel, serial	Parallel, serial, mouse, audio
Slots	7 full-length	None	4 full-length	4 full-length	1 full-length, 1 8-inch
Keyboard style	Original AT	Proprietary	Proprietary	Original AT	84-key Space-Saving keyboard
Clock/calendar	•	○	○	•	•
Software	005 3.2, GW-BASIC, Executive Writer, Executive Filer, MyCalc, Not. AT! training system, HeadStart shell	005 3.2, GW-BASIC, MS-005 Manager	005 2.11, PC Tutor, PC-Pol, Electric Desk	005 3.2	None
CONFIGURATION TESTED					
Price of configuration tested	\$1,395	\$1,199	\$1,095	\$1,195	\$2,228
Configuration tested	768K RAM, color monitor	ezYz-2 with second 3½-inch disk drive	Base unit	Base unit	Color monitor, 640K RAM, second floppy disk drive, Collegiate Kit
SPECIFICATIONS					
Microprocessor	8086-2	NEC V20	8086-2	8086-2	8086
Clock speed (MHz)	4.77/6	7.14	4.77/8	4.77/10	8
Controller card handles	2 floppy disk and 2 hard disk drives	2 floppy disk drives	2 floppy disk and 1 hard disk drive	2 floppy disk and 1 hard disk drive	2 floppy disk drives
OTHER					
Warranty	1 year	1 year	90 days	1 year	1 year
BIOS manufacturer	Phoenix	Vadim	Up to Date	Award Software	IBM

• — Indicates Editor's Choice • — Yes ○ — No

You know the desktop computer's standard look. It includes a two-tone ivory box (system unit) stuffed with motherboard, drives, and expansion/adaptor boards. The standard look also includes a keyboard that stands on tuck-away back feet and a separate ivory monitor that sits atop the system unit.

When IBM decided to come up with an advanced technology machine (the PC AT), the look stayed the same. The system unit got bigger, but the basic IBM style was still there. The only change was the addition of the lock on the front panel.

It has been important for the makers of clones, compatibles, and work-alikes to adopt the IBM electronic standard for buses and pinouts and ROM (legally and illegally). But for some reason they have usually decided to adopt the standard look as well. At least until now.

TELL ME WHY Recently some compatible manufacturers (and even IBM itself) have considered the IBM look and, much to their credit, have asked the simple question, why? Why does a machine have to look like a PC or AT when some other form might better meet the needs of some special segment of the marketplace?

After all, there's a lot of air in PC and AT boxes if you don't need a forest of expansion boards. Why not squeeze out the air, make the package smaller, and put full-power PCs into places where they haven't fit well in the past?

The typical college dorm room is a small place full of very real dangers for a PC. Yet many colleges today require students to show up on day one with a PC in tow. Imagine the desk space that remains after two or more roommates set up their full-size AT knockoffs.

Then, too, there are small-business and home users who find desk space more valuable than expansion board space. Why shouldn't there be machines for these people to buy?

Finally, there are potential users who want computer services without having to learn about computer hardware, DOS, pinouts, boards, and all the other minutiae that cloud our thinking. This may be the most important consideration; after all, you can put any PC on the floor if you have enough cabling.

For these people, part of the answer can include bundled software and setup instructions written for human beings. If the setup instructions begin with "How to get the pieces out of the box," so much the better. In cases where computerphobia is a malady that must be conquered, every little bit helps.

■ PACKAGED COMPUTERS

NEW DESIGNS The five machines in this roundup—the Acer 710, Cordata WPC, IBM Personal System/2 Model 25, Vendex Turbo-888-XT, and Zenith caZy pc—are each designed to meet one or more of the whys or why nots discussed above.

All are small-footprint machines; that is to say, they take up less space than a standard PC or AT. Only two of them bear any resemblance to the PC AT standard. All come with the pieces that most people want—drives, parallel and serial ports, graphics drivers, and a monitor—so setup is relatively simple. Some come bundled with word processors, spreadsheets, and DOS shells. With monochrome monitors included, these five machines range in price from \$995 to \$1,350.

Some of these computers are specifically designed for the college market, and one even tucks its monitor into a plastic shell that will protect it from the things that sometimes fly around dorm rooms.

In August, Tandy joined this crowd with revisions of its two popular 1000 series computers, the all-in-one keyboard/system unit 1000 EX and the more conventional (three-piece) 1000 SX. The two new machines—the \$699 (without monitor) 1000 HX and the 80286-based, \$1,199 1000 TX—are expected to earn a big market share in this category. Evaluation units were unavailable at the time of this review, but PC Labs will soon be taking a close look at both models.

So, if you're looking for a low-cost, small-footprint PC-XT-class machine that is designed, for the most part, to begin doing useful things the minute it comes out of the box, you may find that your search ends with one of the following machines.

ACER TECHNOLOGIES CORP.

Acer 710

Perhaps you're in the market for a small-footprint machine with all the basics, plenty of growth capability, and no bundled software (although MS-DOS is usually considered a given in a "no-software" machine). If so, you may want to take a look at the offerings of Acer Technologies.

Acer is the newly formed affiliate company of Multitech Electronics Inc. (MEI), which in recent years has marketed low-cost systems and peripherals under the

name Multitech. Thus, we have the "Acer" computers: models 710D, 710M, and 710C.

The unit we looked at for this review is the \$1,195 Model 710M. That's the low-

est-cost Acer system that has a monochrome monitor (hence the M designation) and is therefore the least expensive Acer that comes ready to run right out of the box. Its only software is MS-DOS 3.2.



The Acer 710 from Acer Technologies is one of the most normal-looking of the packaged computers. Its familiar three-piece design includes separate monitor, keyboard, and system unit with two floppy disk drives. The motherboard can accommodate up to four full-length XT expansion boards, and a hard disk option is available, making this machine more configurable than some of its competition.

SMALL FOOTPRINT The Acer 710M system looks like a PC-XT clone, except that the system unit is roughly 25 percent smaller than the standard IBM size. It measures 5 by 16.2 by 14.2 inches (HWD) and weighs 30 pounds. The 84-key original AT-style keyboard weighs about 4 pounds.

The system unit package is not unattractive, but it may have been designed more for looks than functionality. It's flawed in the same manner as the Cordata WPC, also reviewed here: in its raised position, the back of the keyboard is higher than the B: drive slot. In order for a floppy disk to be inserted into or removed from the B: drive, it must be bent or the keyboard moved.

A plus for the system unit is that it has a cutout on the left side to accept a 3½-inch microfloppy drive along with the standard dual, half-height, 5¼-inch floppy disk drives on the right. This could be an advantage for the individual who runs a desktop machine at home and a laptop on the road.

The standard 710M comes equipped with 768K RAM, a clock/calendar with battery backup, two half-height 5¼-inch floppy disk drives, one serial port, one parallel port, and a 12-inch soft-white monochrome monitor. RAM above 640K is assigned at boot-up to a RAM drive and other internal purposes.

The heart of the system unit is an Intel 8088-2 microprocessor that runs at 4.77 or 10 MHz. Normal boot-up is at the 10-MHz speed. Speeds are key- or software-selectable.

All Acer computers are delivered with a standard display adapter that functions as a high-resolution monochrome text (80 columns by 25 lines) adapter, a Hercules-type monochrome text/graphics adapter (the latter at 720- by 348-pixel resolution), or an IBM standard Color/Graphics Adapter. Acer can supply monitors of any description with the system unit.

Despite the fact that the Acer keyboard makes a very effective blockade to the B: drive, it is a well-designed device. The key layout is original AT-style, with ten function keys to the left of the alphanumeric area. While the spring loading is not as

■ A plus of the Acer system is its growth potential, despite its diminutive size.

tight as IBM's and the click is less pronounced, the keyboard does have tactile feedback and perfectly spaced keys. If you move back and forth between an IBM at work and an Acer at home, you won't be making mistakes at either end.

GROWTH POTENTIAL Another plus of the Acer system is its growth potential, despite its diminutive size. The system unit will accommodate four full-size IBM-compatible expansion boards. Acer itself offers plenty of options to fill those slots, including an enhanced color graphics card and an internal 300/1,200-bit-per-second modem.

Besides the M configuration that we reviewed, the Acer 710 comes in a D system (you supply the monitor, \$1,049); a C system (14-inch CGA monitor, \$1,459); a C2 system (RGB monitor, two floppy disk drives, and one 20-Mbyte hard disk card, \$2,029); and as diskless workstations priced from \$555 to \$779.

The Acer 710 is neither especially good nor bad from viewpoints of technological application and implementation—or of its price. Its 10-MHz clock speed made it one of the best performers in benchmark test-

ing, but compared with most of the other machines evaluated here, it is a plain-vanilla, small-footprint machine for traditionalists.

CORDATA TECHNOLOGIES INC.

Cordata WPC

Although the small-footprint Cordata WPC was designed for small business and home applications, many of its features seem ideal for the student user. Indeed, this machine may find its biggest market among the college crowd.

Much of its appeal to that market is in its ruggedness and its single-unit construction. Cordata is the only system designer, to my knowledge, that has built a hard cover to protect the display screen. This cover has two spring-loaded clasps that fit into the frame of the monitor case.

Obviously, the person who came up with this idea had spent enough time in college dorms to know that things like shoes and beer cans occasionally become missiles in the heat of academic discussions.

Like the other PCs reviewed here, the WPC is designed to include the most-wanted PC features in a relatively small package at a relatively low price. In this case, the unitized package is indeed small, and the price tag of \$1,095 speaks for itself.

Included in the basic system are an 8088-2-based, 8-MHz system unit with 512K on the motherboard and room to upgrade to 768K. The system also includes two 5¼-inch, 360K floppy disk drives,



FACT FILE

Acer 710

Acer Technologies Corp.
401 Charcot Ave.
San Jose, CA 95131
(408) 922-0333

List Price: With 768K RAM, two 5¼-inch floppy disk drives, 12-inch soft-white monitor, DOS 3.2, \$1,195; without monitor, \$1,049; with 14-inch CGA monitor, \$1,459; with 20-Mbyte hard disk, \$1,795.

In Short: A plain-vanilla PC compatible that is well built and low priced, but not particularly innovative.

CIRCLE 600 ON READER SERVICE CARD



FACT FILE

Cordata WPC

Cordata Technologies Inc.
2001 Corporate Center Dr.
Newbury Park, CA 91320
(805) 375-1580

List Price: With 512K RAM, 12-inch monochrome monitor, two 5¼-inch floppy disk drives, DOS 2.11, \$1,095; 20-Mbyte hard disk card, \$999; 300/1,200-bps internal modem, \$129.

In Short: A rugged, one-piece unit that even comes with a monitor protector. Perfect for the college dorm.

CIRCLE 600 ON READER SERVICE CARD

one serial port, one parallel port, and a monitor/graphics driver. The latter will handle monochrome, CGA, or AT&T 6300 graphics. CGA monitors are driven via an external port.

Integrated into the Cordata case is a 12-inch monochrome monitor. The monitor tube is mounted so that it can tilt up or down inside the case.

The system also comes with MS-DOS

2.11, *PC Tutor*, *PC Pal*, and *Electric Desk* software.

Conceptually, the machine makes sense. It is neatly packaged in one box with a relatively small footprint: 14 by 15 inches. Like the IBM PS/2 Model 25, the WPC is heavy (40 pounds), so it is stable as well as compact.

LOW-SLUNG B: DRIVE But compactness has its price. Like the Acer 710, the WPC has a B: drive that is blocked by the top of the keyboard when the keyboard is in its raised position.

One way around this problem is to use DOS to redirect drives, but that could make things tremendously complicated with a program that looks for various elements on different disks. It looks as if the package designers (who had in all probability never used a PC) got a bigger vote than the in-house engineers on this one.

On the positive side, the designers left room for four IBM-compatible expansion slots. They also put together a keyboard that mimics IBM's Enhanced style. The keyboard lacks much of the IBM-quality tactile feedback and clickiness, but its key spacing is good.

SIMPLE SETUP Another positive feature is the ease of setup and transport, a real plus for the college crowd. The WPC's two major elements—integrated system unit/monitor and keyboard—are packaged in one carton along with cables, documentation, and master disks.

Setup involves unpacking the units, plugging the keyboard into the system unit, and plugging the system unit into the wall socket. Insert a DOS diskette, and you're done.

The familiar *PC Tutor*, along with the desktop services of *Electric Desk*, gives the new user a boost on operations. *Electric Desk* (Version 1.1), a product of Alpha Software Corp., is a nicely integrated package that includes basic word processing, database management, spreadsheet analysis, communications services, and, of course, file transfer among the *Electric Desk* components. *Electric Desk* is menu driven, makes extensive use of the function keys, and usually prompts the user for the next action.

Electric Desk certainly brings the stu-



With the exception of IBM's PS/2 Model 25, Cordata Technologies' Cordata WPC is the most rugged of the packaged computers. The monitor, which is grafted onto the system unit, is encased all around in a protective plastic shell, and this solid construction makes it ideal for school use. The WPC comes bundled with *Electric Desk* software and good documentation that will aid the first-time user in getting started.



■ PACKAGED COMPUTERS

dent (or small-business owner) all the software power he needs to get started, and this is a system that can grow with the user. Cordata is offering a 20-megabyte hard disk for \$599 and a 300/1,200-bit-per-second internal modem for \$129.

The B: drive clearance is certainly a problem, but this machine's all-in-one construction and the monitor shield suggest it may be just the thing for the college-bound or first-time small-business user. The price of the basic machine and its bundled software certainly make it look competitive in this group, as does its support from Cordata's established dealer network—some 1,400 dealers around the country.

IBM CORP.

IBM PS/2 Model 25

When IBM announced its smallest Personal System/2 machine, the Model 25, on August 4, it was greeted with yawns by some hardware reviewers and downright hostility by others.

The reviewers seemed polarized into two camps: One group said the Model 25 can't do all the stuff that IBM-made machines should. It isn't expandable into a near-mainframe machine. It can't drive 20 dumb terminals. Its microprocessor won't address 6 million bytes of RAM. Who wants a machine with the IBM logo that won't do all that? they asked.

The other group focused on the price. This IBM-made machine, they said, at \$1,350 to over \$2,000 with color monitor and other options, is 30 to 40 percent more expensive than the competition. When will IBM learn to make something truly cheap? they asked.

Now that I've had a chance to look at the machine myself, I'll tell you—at the risk of getting drummed out of the reviewer corps—that I liked the Model 25, even though IBM's decision to cast it as a member of the PS/2 family is based more on euphemistic marketing than on technological innovation. I think it does just what it promises—no more, no less. And I think the retail price—which doesn't count for schools since they routinely get a 40 percent discount, or for volume purchasers, who usually get 30 percent off—is fine for a machine with the IBM logo.



The IBM PS/2 Model 25 is an exceptionally rugged machine that will find its way into many classrooms. It even sports a bar on its base that can be bolted down to a desk. The \$1,865 system pictured here includes a second floppy disk drive and a color monitor. Two expansion slots are available inside to accept expansion boards or a hard disk card from a third-party vendor.

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HARD DISK POWER FOR THE MODEL 25

IBM has denied you a hard disk for your Model 25, but third-party vendors will be more than happy to accommodate your mass-storage needs.

IBM executives drew chuckles at the introductory press conference for the PS/2 Model 25 when, in response to a reporter's question, they explained that the only way to get a hard disk in a Model 25 was to buy a Model 30 instead.

IBM's nasty habit of building limitations into its computer family members in order to make sure the more powerful models sell is always taken advantage of by an active aftermarket that fills the gaps. CMS Enhancements of Tustin, California, the first company to offer alternative mass storage options for the PS/2 family, is also the first company to introduce hard disks for the Model 25.

Just one day after the Model 25 announcement was made, CMS announced four hard disk subsystems that come in formatted capacities of 20, 30, 40, and 49 megabytes.

All the available hard disks are external units. The 20-megabyte K20M25, with an access time of 80 milliseconds, costs \$595. The 30-megabyte K30M25 has an access time of 35 milliseconds and sells for \$895. The 40-megabyte K40M25 has an access time of 80 milliseconds and a price of \$799; rounding out the line is the 49-megabyte, 35-millisecond K49M25 at \$995.

For more information on these drives,

contact CMS Enhancements, Inc. (1372 Valencia Blvd., Tustin, CA 92680; (714) 259-9555).

For internal mass storage, Plus Development Corp. offers its popular Hardcard 20 and Hardcard 40 as solutions. The \$795, 20-megabyte drive and the \$1,195 40-megabyte drive have been tested in a Model 25 expansion slot; they run with perfect compatibility. Contact Plus Development Corp. (1778 McCarthy Blvd., Milpitas, CA 95035; (408) 946-3700).—Donald P. Willmott

Donald P. Willmott is an assistant editor of PC Magazine.

WHAT YOU GET The Model 25 is designed primarily to be simple, compact, rugged, and (more or less) ready-to-go out of the box, and it meets all these requirements.

The Model 25 comes in two parts: a keyboard and a one-piece system unit/monitor. The customer can pick monitor type (monochrome or color), number of drives (one or two 3½-inch floppy disk drives), and keyboards (84-key Space-

Saving design or 101-key IBM Enhanced, each with 12 function keys).

Our evaluation system came equipped with two disk drives, a color display, and the Space-Saving keyboard. It also came with the Collegiate Kit, a \$314 option for creating an ersatz Macintosh that includes *Microsoft Windows*, Version 1.04, PC-DOS 3.3, a mouse, and an IBM word processor with text and graphics features sufficient for the production of most college papers.

This machine is perfect for a desktop, even the small desktops usually found in college dorms. Its base is only 9.5 inches wide by 14 inches deep, and it weighs 28 to 37 pounds, depending on the monitor. The relatively high base loading (pounds of weight to footprint area) gives the machine stability.

EXPANSION SLOTS Although the Model 25 has two expansion slots (one full-size and one 8-inch), getting into the integrated system-unit/monitor housing is no simple task. With the display end of the box facedown on the desk, the bottom of the unit opens on a hinge to reveal the expansion slots, but closing it again can take some time and patience unless you are

lucky enough to get the screw paths lined up on the first try.

But, as is the case with many of these machines, there are few reasons to bother getting inside. The Model 25 is equipped with an 8-MHz Intel 8086. That's more

■ The IBM PS/2 Model 25 is designed to be simple, compact, rugged, and (more or less) ready-to-go out of the box.

than enough power for typical student/home computing needs. Standard RAM is 512K with parity checking. If you need 640K, you can get a 128K expansion kit—chips that plug in to the system board—for \$49.

Also standard (and accessed at the rear) are a parallel port, a mouse port, a serial port, and an audio port in case you want to blow your beeps through an external amp.



FACT FILE

IBM PS/2 Model 25

IBM Corp.

Consult your local authorized dealer.

List Price: With 512K RAM, one 720K 3½-inch disk drive, 12-inch monochrome monitor, \$1,350; IBM MCGA color monitor, \$345; Collegiate Kit package with mouse, PC-DOS 3.3, *Microsoft Windows*, tutorial, \$314; second disk drive, \$170; IBM Enhanced keyboard, \$45; 128K RAM expansion, \$49.

In Short: A new and much-maligned member of the PS/2 family that, in reality, delivers no more and no less than it promises.

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KEY DIFFERENCES

Whenever small-footprint machines are designed, attention turns to keyboards and how they can be shrunk to stay in line with the smaller system units they accompany. In four out of the five cases below, designers have retained separate numeric keypads. The IBM PS/2 Model 25 can be purchased with the standard IBM Enhanced keyboard; the Space-Saving design pictured here has an embedded numeric keypad. All of these keyboards also have a full complement of function keys. Acer, Vendex, and Zenith arrange theirs in two columns on the left side; Cordata puts ten across the top, and IBM mimics the Enhanced style, with 12 function keys grouped in sets of four across the top.



The Space-Saving keyboard of the IBM PS/2 Model 25 is essentially an Enhanced keyboard with the numeric keypad cut off. A standard 101-key model is available for \$45.



The keyboard of the Acer 710 is the original AT-style, with enlarged Enter key and LED indicators for CapsLock, ScrollLock, and NumLock.



The 84-key keyboard of the Vendex Turbo-885-XT includes a separate numeric keypad and enlarged Enter key. LED indicators are included within the keys they report on.



The Cordata WPC features an 84-key keyboard with function keys arrayed across the top. Like the Acer 710's keyboard, it has LED indicators, a nice touch.



By swapping the Esc and Tilde keys, Zenith has made a small but maddening mistake on the keyboard of the eoZy pc. The Esc key is at the upper left, the Tilde on the right.

Our test unit came with the optional \$345 color monitor driven by IBM's Multi Color Graphics Array. This system supports several text modes and graphics modes of 640 by 480 pixels with two colors on-screen, the latter selected out of a palette of 262,144 colors. The MCGA driver is on the system board. The monitor produces bright, pure colors and crisp text.

All operations are simple, as intended. The power switch is mounted under the monitor overhang on the right side. Once turned on, the system takes 30 seconds to test its major components with the familiar IBM RAM countdown.

The 64K ROM contains BIOS support and the BASIC language interpreter as well as start-up and self-test routines.

KEYBOARD DECISIONS The new 84-key Space-Saving keyboard—essentially the Enhanced design with its numeric keypad amputated—has a good, solid feel but a bit more springiness than the full-size Enhanced keyboard (available as a \$45 option). The smaller keyboard does not have the breakaway "click" of the familiar big IBM keyboards, but then again, it doesn't have the soggy feel of some less expensive keyboards either. Its embedded numeric keypad and T-shaped cursor controls are easy to learn and comfortable to use. The Space-Saving keyboard can also be used with the rest of the PS/2 line, though IBM does not acknowledge the fact.

In terms of the Model 25's much maligned functionality, it must be pointed out that this machine does everything the original IBM PC did—at twice the speed and in 60 percent of the space. Despite some reports to the contrary, it can live in a classroom LAN environment if necessary, and it can even act as a desktop terminal in an office environment.

A look at the benchmark times shows that the Model 25, with its 8-MHz clock speed, is certainly no slouch when compared with its peers, testing at least 50 percent faster than the original XT in all categories. Its floppy disk access, however, was the slowest tested, coming in at 322.2 milliseconds.

Volume buyers, especially school administrators, face the dilemma of trying to choose between the Model 25's ruggedness (it is the toughest classroom PC and

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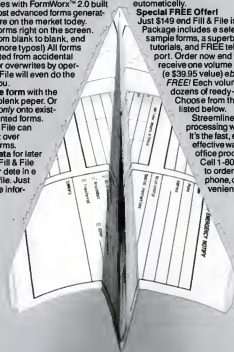
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■ PACKAGED COMPUTERS

even comes with a special bolt-down bar) and the more aggressive pricing from large-volume manufacturers like Tandy.

The price for the Model 25 is slightly above the average for this class of equipment, but remember that the most trusted and respected label in any marketplace can usually command top dollar. Think of BMW versus Volkswagen or Nikon versus Vivitar. Some company always gets the top ticket because of its name (logo), and in this industry it's Big Blue.

VENDEX PACIFIC INC.

Vendex Turbo-888-XT

Surely, you've heard the term *turnkey*. That's an arrangement in which a vendor delivers your mainframe, sets up your software including applications, debugs the whole mess, then hands you the key and the invoice.

It makes sense to buy your next Cray system that way, but how about an under-\$1,000 PC-XT compatible in a small-footprint box?

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The Vendex concept is simple. First, build (or get a competent manufacturer to build for you) a PC-XT compatible equipped with all the slots, drives, ports, and controllers that most users want. Next, bundle the system with a DOS shell, a spreadsheet, a word processor, a filer, and a desktop manager (calculator, appointment calendar, etc.); in short, all the applications most first-time users will need.

Price the whole works under a thousand dollars (\$995, to be exact), document it extensively, and, if all that isn't turnkey enough, have a bonded installer set it up for the end user for an extra \$49.

SMALL MACHINE, BIG NAME The product (as well as the concept) is called the Vendex HeadStart Computer System. The HeadStart system is based on the Vendex Turbo-888-XT. The hardware system unit looks like an IBM PC AT that has shrunk to about two-thirds of its original size. The system uses an Intel 8088-2 microprocessor that boots up at 8 MHz (4.77 MHz is key- or software-selectable).

The HeadStart configuration includes

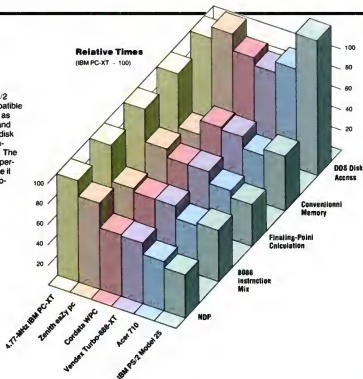


No other computer takes the concept of "all-in-one" further than the Vendex Turbo-888-XT, the integral component of the Vendex HeadStart Computer System. Priced at \$995, the system includes 512K RAM, two floppy disk drives, and a variety of software, including DOS 3.2. A \$549 auto-formatting 20-megabyte hard disk card is available to be placed in one of the five available expansion slots.



Benchmark Tests: Packaged Computers

Though the Acer 710 and the IBM PS/2 Model 25 are classified as PC-compatible machines, both were consistently twice as fast as the original IBM PC in memory and processor tests. The Model 25's floppy disk drives, however, are sluggish when compared with those of the other machines. The Zenith eaZy pc's NEC V20 processor, operating at a clock speed of 7.14 MHz, made it the slowest computer in this group in processor-based operations.



Performance Times

(Times given in seconds except where noted)

	NOP	8086 Instruction Mix	Floating-Point Calculation	Conventional Memory	DOS Disk Access (milliseconds)
4.77-MHz IBM PC-XT (360K floppy disk drive)	10.1	32.0	159.2	5.9	242.3
Zenith eaZy pc	8.6	20.5	108.4	2.9	268.9
Cordata WPC	6.1	19.5	95.6	3.6	230.3
Vendex Turbo-886-XT	6.0	19.4	95.0	3.5	212.5
Acer 710	4.8	15.6	76.3	2.8	237.0
IBM PS/2 Model 25	4.2	16.3	65.9	3.2	322.2

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3, and the interleaves factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

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- Clock-calendar with battery backup
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- SpeedStor partitioning software

12MHz, 70MB MonoGraphic System. \$2049

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- 70MB fast access (28 ms) MiniScribe hard disk
- SpeedStor partitioning software

12MHz, EGA Color System. \$1549

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- 14" high-resolution EGA color monitor
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- 6 to 10MHz switchable clock speed
- 640KB RAM
- 360KB diskette drive
- Diskette drive controller
- AT-style keyboard
- 150-watt power supply

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■ PACKAGED COMPUTERS

clock and calendar circuitry with battery backup, 512K RAM, two 360K 5¼-inch floppy disk drives, and a high-resolution graphics card that will drive monochrome, Hercules, and color-generated graphics. The basic system also comes with a high-resolution TTL monochrome monitor mounted on a tilt-swivel base.

Also included are a parallel port, a serial port, a mouse port, a game port, and a floppy disk controller capable of handling four floppy disk drives.

Besides DOS 3.2, standard software includes a proprietary shell called HeadStart written by Executive Systems, the *Hot* desktop manager from Executive Systems (an Editor's Choice in "Having It All—DOS Shells with Macros," Volume 6 Number 16), *Executive Writer* and *Executive Filer* from Paperback Software, and the *MyCalc* spreadsheet from The Software Tool Works.

Dozens of coupons for MS-DOS-compatible software, extended service programs, and miscellaneous hardware accompany the basic package.

READ ME Assuming for the moment that the user decides to be brave and assemble his own HeadStart system (rather than have the bonded service technician do it), the job is a snap—even for a technophobe. As soon as you peel back the flaps of the system unit box, you are greeted by a pamphlet decorated with a giant red "stop" sign and the polite entreaty to

"read me before you do anything else."

Actually, there is very little reading to do in this pamphlet. It contains 21 line drawings that show you how to unpack the boxes, how to assemble the components (system unit, monitor, keyboard, and cables), how to wire up everything, how to find the start-up diskette (it's marked with a one-inch-high character *I*), and how to turn on the switch.

When you hit the switch, the ROM goes through a self-test routine and boots up the HeadStart shell. The first selection on this menu invites you into an interactive training session designed by ATI. You learn what makes your computer tick, how to care for diskettes, how to use the keyboard and drives, and, of course, how to use the shell.

The HeadStart shell can access any of the applications programs; it also prompts you with instructions such as "Insert the blue disk with the big number 2." Later on, the user can add his own programs to the shell.

I liked this machine. It is not very fancy in terms of its technology or its software, but at \$995 for the 512K monochrome system, the HeadStart system does seem to supply a considerable amount of computer power for the dollar, and it certainly offers a turnkey package ideally suited to the person who wants to get into computing with minimum investment and hassle.

The bundled software does not represent the best word processor or best spreadsheet on the market, but it does offer all the word processing and spreadsheet power that the average first-time user or college student will need.

Unlike some of the other machines reviewed in this article, the Samsung-built Turbo-888-XT has growth potential. There is room in the system unit for a hard disk, and there are seven full-size slots (five available) for board expansion.

Vendex is beginning shipment of a line of peripherals including a 20-megabyte hard disk card that formats itself automatically (\$549), a 1,200-bit-per-second external modem (\$249), and a 256K RAM upgrade kit (\$99.95).

You may be worried about buying computer equipment from a company whose name you don't recognize, but Vendex Pacific is a wholly owned subsid-

iary of the \$9-billion, Netherlands-based multinational conglomerate Vendex International. That fact alone doesn't mean its computers are any better or worse than the others on the market, but at least you needn't worry about the solvency of the parent company. It's not a basement operation located in the Dallas suburbs.

If you are looking for a one-stop, easy-to-manage, low-cost system for the college student in your family (or for yourself, for that matter), shop around, but be sure to consider the Vendex machine.

ZENITH DATA SYSTEMS

Zenith eaZy pc

Imagine a one-piece PC-XT compatible that comes out of a single shipping carton, ready to use. Imagine also that not only are there no expansion slots, but the user is actually forbidden to open the system unit.

Imagine that the only technical elements of this machine that must be mastered are how to move the power switch to the On position and how to insert or remove a 3½-inch microfloppy diskette.

And finally, imagine that the machine's integral 14-inch, high-resolution monochrome monitor is the most eye-pleasing display you've ever seen. (It displays text and graphics in black characters on a soft-white background.)

If these images of competent simplicity in the seemingly over-complex world of microcomputers appeal to you, then so too will Zenith's new, low-priced PC called, appropriately enough, the eaZy pc. The



EDITOR'S

FACT FILE

Vendex Turbo-888-XT

Vendex Pacific Inc.
40 Cutter Mill Rd., #438
Great Neck, NY 11021
(516) 773-4883

List Price: With 512K RAM, two 5¼-inch floppy disk drives, monochrome monitor, DOS 3.2, *Executive Writer*, *Executive Filer*, *MyCalc*, *Hot*, \$995; with color monitor, \$1,295; 256K RAM upgrade kit, \$99.95; 20-Mbyte hard disk card, \$349.

In Short: A completely packaged PC that comes with everything the first-time user could possibly need, including a shelf of software.

CIRCLE 666 ON READER SERVICE CARD



FACT FILE

Zenith eaZy pc

Zenith Data Systems
1000 Milwaukee Ave.
Glenview, IL 60025
(800) 842-9000

List Price: With 512K RAM, one 720K 3½-inch floppy disk drive, 14-inch soft-white monitor, DOS 3.2, \$999; with second floppy disk drive, \$1,199; with 20-Mbyte hard disk drive, \$1,699.

In Short: A well-designed one-piece unit (plus keyboard) that is most notable for its outstanding hi-res, paper-white monitor.

CIRCLE 666 ON READER SERVICE CARD

eaZy pc comes in three configurations: a \$999 model with a single 720K 3½-inch floppy disk drive; a \$1,199 model with two 3½-inch drives and a \$1,699 version with one 3½-inch floppy disk drive and a 20-megabyte hard disk. All three models

come with 512K RAM, one parallel port, and a serial port for mouse hookup.

WHERE'S THE COMPUTER? Zenith has had the courage to make a PC-XT compatible that doesn't look like one. The

system unit is a low-profile box (3.5 by 14 by 15 inches HWD) that looks more like a fancy monitor stand than a CPU. In fact, it does function as a monitor stand in that the monitor is attached to the system unit by a universal joint. The monitor swivels left and right and tilts up and down.

The 3½-inch drives (our evaluation unit had two) are located on the right side of the system unit. Each has its own LED to indicate read-write activity, and a master-disk-access light is mounted on the right front of the system unit alongside a power-on light for easy viewing.

The only element that spoils an otherwise flawless design is the location of the main power switch, which is mounted on the rear of the monitor where you usually expect to find things like vertical hold.

■ Zenith has had the courage to make a PC-XT compatible that doesn't look like one.

This positioning forces you to lean across the keyboard and blindly grope your way around the back of the monitor for the switch.

In performance tests, the Zenith's 7.14-MHz NEC V20 processor rendered it slightly slower than the other machines with their high-speed processors and switchable clock speeds. Its disk access was slow—slower in fact than all the other computers with the exception of the PS/2 Model 25.

SIMPLICITY Much of the simplicity of the eaZy pc comes from the limited ways you have to enhance it. A 25-pin Centronics-type parallel connector and a 9-pin serial connector are available at the rear for connecting external devices. These are standard.

Zenith also brings the data bus to a rear connection to accept one of two available modules: a modem/memory/serial module or a memory-only module. Both these modules bolt onto the rear of the system



The two most remarkable features of the Zenith eaZy pc are its system unit's tiny size (3½ by 14 by 15 inches) and its ultrasharp high-resolution monochrome monitor. The monitor is mounted atop the system unit on a tilt/swivel base. Standard equipment for the \$995 machine includes one floppy disk drive, 512K RAM, and DOS 3.2. Adding a second floppy drive raises the price to \$1,199.



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■ PACKAGED COMPUTERS



EDITOR'S CHOICE

• Vendex Turbo-888-XT

If we begin with the premise that these machines are competing for king of the hill in the world of the small-footprint, low-cost, "do something right out of the box" market, the winner has to be the Vendex Turbo-888-XT.

The Vendex has unbeatable documentation, and it comes bundled with all the software most students, homeowners, or small-business owners will need, at least in the beginning. And despite its several ports and 512K of RAM memory on the motherboard, there's still room for more using standard IBM-compatible expansion cards.

A close runner-up is the Zenith eaZy pc. If we assume that the ideal ready-to-go machine won't need much in the way of growth potential, the Zenith machine is a beauty. There are no pieces to put together; you pull it out of the box and plug it into the wall. To the extent that growth is necessary, expansion modules plug into the outside of the machine so that the end user doesn't have to be a system unit mechanic to get a modem up and running. Its high-resolution, soft-white screen will be a much-beloved eye saver for the student, writer, or businessman who spends the better part of his working day in front of a CRT.

unit at the bus port. As its name implies, the modem/memory/serial module contains a 300/1,200-bit-per-second modem, a separate 9-pin connector to comm 2, and an extra 128K of memory.

Because the memory module contains only 128K, the addition of either module brings total system memory up to 640K and no further. The only other Zenith-offered options are a mouse and a real-time clock. (The clock is a dealer-installed chip.)

Another aspect of the eaZy pc's out-of-the-box simplicity is its bundling with the first release of Microsoft's MS-DOS Manager, a DOS shell (based on *Windows*) with drop-down menus. A first-time user can spend 5 minutes with a text tutorial and be happy ever after letting MS-DOS Manager do the driving.

The Zenith keyboard design resembles that of the original AT keyboard except for one maddening difference: Zenith has reversed the Escape and Tilde keys. The only place I've ever seen tildes used is in 1-2-3 and Plan Perfect macros. The Escape key, however, is used in many programs, and I like it in the now familiar position above the Home key. In the world of keyboard ergonomics, the eaZy pc probably rates a low "C."

Keyboards and power switches aside, this is an exciting machine. Its features seem ideally suited for its intended audi-

■ The Zenith eaZy pc is bundled with the first release of Microsoft's MS-DOS Manager.

ence: college students, home users who want computer services but don't see computing as an avocation, and office users who have relatively simple needs.

But above all else there is the monitor. I think we'll be seeing a lot more of it in other applications soon. Zenith engineers say they've used the same double-scan video technology as that on IBM's PS/2 Model 30, which yields a graphics capacity of 400 by 200 pixels.

Five neighborhood reviewers—two kids and three adults, all with little computer experience—watched me run the PC Labs monitor benchmark tests on all the machines in this review. The results of this unscientific poll put Zenith's soft-white, high-resolution monitor at the top of the "we-want-ours-like-that-one" list. ☐

Richard Aarons is a contributing editor of PC Magazine.



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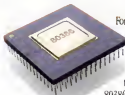
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CIRCLE 350 ON READER SERVICE CARD

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SOUTHWARE TAKES THE FUTURE INTO ACCOUNT

SouthWare Business Series, an integrated accounting software package from SouthWare Innovations of Auburn, Alabama, is feature rich and flexible. It runs on machines ranging from XT's to local area networks to powerful superminicomputers, providing a viable upgrade path as your business grows.

Sophisticated features that would have to be custom programmed in many other packages come standard in SouthWare; particularly impressive are the program's multiuser capabilities, which outshine those of most rivals. The product has an intuitive checklist menu scheme that helps structure the work flow and simplify training and control. Although SouthWare certainly isn't cheap, it can quickly pay back its extra cost in reduced training and operations time. Its completeness should appeal not only to accountants and auditors but to business owners as well.

To get the most from SouthWare's sophisticated features, you can't scrimp on hardware. A fast processor and plenty of disk space will pay off in software performance, with quicker access and higher transfer rates. We recommend a 286 machine with at least a 30-megabyte hard disk drive. The program files for each module installed will consume about 1.2 megabytes of disk space, and you'll need additional room to store transaction detail, keep daily operations logs, spool reports,

and maintain menu shortcuts, which let you move quickly from screen to screen.

SouthWare's program files are installed in a separate directory on your hard disk; data files for different companies go into subdirectories. Like the software's other functions, setup procedures are all menu driven and include some useful features. One menu option, for example, estimates the size of your data file after you answer a series of questions, an aid in managing your hard disk.

FRIENDLY MENUS You'll quickly warm up to SouthWare's user interface. For one thing, the menus are set out in checklist order—you proceed smoothly from first to last option, executing a complete process in a straightforward, orderly fashion. The menus are also well integrated with the program's documentation. The upper-right-hand corner of each screen displays a reference number keyed to the relevant page of the appropriate manual. The documentation itself is thorough and well designed: each manual explains the accounting concepts and information flow for the module in question and includes a clear diagram showing the sequence of operations.

Also worth noting is the system's effective on-line help, including field-level help in the file-maintenance options. Unlike most packages, SouthWare lets you decide



SouthWare will appeal to accountants, auditors, and business owners who need a flexible, sophisticated, and feature-rich accounting package for their current needs. And because it runs on anything from an XT to a LAN to a super-mini, it will continue to serve for a long time to come.


■ THE PRICE WATERHOUSE REPORT

whether to have help screens appear automatically for each option or to use a help key selectively. The program also increases your flexibility by letting you edit help text or add your own. You can customize menu or screen data to your office environment and thus measurably reduce training time.


This sort of flexibility extends throughout the software. The print-management facility is a case in point. Unlike most accounting packages, *SouthWare* not only will send reports to your screen or printer but will also let you spool them to a file. Moreover, accountants and auditors will be pleased to learn that certain audit trail reports cannot be displayed on-screen without also being printed or spooled to a file. You might expect such sophisticated print-management features in a minicomputer-based system; they are a real bonus on the PC.

At the heart of *SouthWare* are four accounting modules: General Ledger, Accounts Payable, Accounts Receivable, and Inventory/Sales. These programs, discussed in more detail later, can either stand alone or work in concert with each other. Together they provide enough flexibility to handle the basic accounting functions for a range of businesses. But *SouthWare* also offers a bevy of other modules that can expand the software's power both as an accounting system and as a tool for executives and entrepreneurs.

GENERAL LEDGER With *SouthWare*'s General Ledger, the flexibility starts when you set up. If you wish, you can use either of two predefined standard AICPA charts of accounts to save time: one is a two-segment, seven-digit format (NNNN-NNN); the other is a two-segment, ten-digit scheme (NNNNNN-NNNN). The program also lets you define your own account structure—up to four parts, not exceeding six digits each, with a total of no more than 15 positions. Account structures thus can be as complex as NNNN-NNN-NN-NN. Moreover, each part has meaning to the General Ledger report writer, a powerful plus in accounting for divisions, departments, profit centers, and other organizational components. Using identifiable segments, you can save time in preparing individual financial



FACT FILE



SouthWare Business Series
SouthWare
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List Price: Set by dealers. Typical list prices for single-user modules start at: SwiftMate, \$100; Payroll, \$600; Accounts Receivable, \$600; Collections Adapter Option, \$450; Accounts Payable, \$600; General Ledger, \$600; Services Billing, \$750; Inventory/Sales Dual Edition, \$1,200; Assemblies Adapter Option, \$450; ExecMate, \$600; ReportMate, \$600; Typical list prices for multiuser versions are 30 percent more than the single-user price for 2 to 8 users, double the 2- to 8-user price for 9 to 16 users, and three times the 2- to 8-user price for more than 16 users.

Requires: 256K RAM, 10-Mbyte hard disk drive, DOS 2.0 or later.

In Short: A sophisticated package to handle essential accounting chores. Strong order-entry and collections features help you stay current with your customers. Checklist menu approach reduces training time and improves control. Not copy protected.

CIRCLE 100 ON READER SERVICE CARD

statements and performance reports for your company's organizational groupings.

Entering a large chart of accounts can get tedious with *SouthWare*, since each account number must go through the maintenance menu function. (It would have been nice to be able to load your initial chart from an external file.) Once you've entered a chart of accounts for one profit center, however, *SouthWare* lets you copy it to others and then modify it accordingly.

The General Ledger will take transactions from recurring journal entries, from manual journal entries, and from other *SouthWare* modules. The package operates in a batch mode: balanced transactions go into a temporary work file, to be edited and posted later to the permanent file. We like this approach, since it lets an accounting supervisor more easily review work before it is posted. What's more, in a multiuser environment *SouthWare* can generate transaction listings for each log-on ID/terminal combination.

Manual journal entries generally must balance. However, *SouthWare* permits one-sided, out-of-balance entries from an operator with the appropriate security level. To us this looks like a needless feature; a well-run double-entry system shouldn't require one-sided entries at all. A better solution would be to provide a method of transferring an out-of-balance entry to a separate suspense file. That would delay posting until the error is corrected, preventing the tedious task of reentering a transaction later.

Many high-end accounting packages support recurring journal entries, but *SouthWare* goes one step further. When establishing each recurring entry, you can identify the frequency of recurrence—say, the first of every month—using a two-character code. Then, when you want to see your recurring transactions for a particular day, the program presents them to you and lets you view, modify, and select the appropriate entries for processing. Furthermore, you can choose a fixed periodic amount for entries such as rent or use percentages for allocating recurring overhead (like utilities) among different operations.

SouthWare offers uncommon flexibility in manipulating journal entries over time. One unique feature lets you enter a transaction in one period and have it automatically reversed during the next. The software also accepts entries for other than the current period. Transactions to be recorded in previous periods can be entered only by an authorized operator; once those transactions are entered and posted, however, the program updates all following periods to reflect the change, and financial statements for each of the corrected periods can be reprinted. Transactions associated with future periods are held for posting until the affected period's operations are being executed.

The General Ledger report generator is also quite flexible, encompassing the standard financial statements, the Statement of Sources and Applications of Funds, and other custom reports and supporting schedules. The reports can include budgets, prior-year figures, and ratios. Standard formats let you set up your statements quickly and then modify them as necessary. You can print consolidated financial statements from multiple sets of data files,

too. No transactions are processed during consolidation; the system merely combines data present in the files for the various companies.

ACCOUNTS PAYABLE Although you can run *SouthWare's* Accounts Payable module as a standalone package, it also works as an integral adjunct to the Inventory/Sales and General Ledger segments. Furthermore, a Purchasing Interface option can verify the purchase order number and amount entered into Accounts Payable with the information in the Inventory/Sales module, updating the purchase order record accordingly. Invoice, debit, and credit transactions are entered into a work file, where they may be edited before posting to the permanent file. As transactions are entered, their distribution to General Ledger accounts is established, either in detail or in summary. Posting updates Accounts Payable records immediately; actual posting to the General Ledger, however, does not occur until the operator makes a transfer from Accounts Payable.

SouthWare lets you set up payment restrictions by vendor name, invoice, or both. You can also assign a status identification code to prevent the entry of transactions for certain vendors. As with the General Ledger program, you can set up the Accounts Payable module to handle recurring payment transactions, with the review and execution of these transactions controlled by the operator.

The system can process information relating to manual and prepaid checks, handle partial payment of invoices, and post voided checks, reinstating the invoices that had been marked "paid." One-time payments are categorized under "miscellaneous vendor." The system also lets you specify and print a list of outstanding and cleared Accounts Payable checks, an aid in bank-statement reconciliation.

The module's comprehensive standard reports include a flexible option that outlines your payables-related cash needs as of any given date. Accounts Payable also gives you the ability to generate special reports by setting up two extra user-defined fields in the vendor file. One field, User Area, accepts a text entry up to 20 characters; the other, User Flags, takes up to five individual one-character codes. You might

Inventory / Sales		Round City Appliance	IS-88
Installation and Set-Up Procedures			TIME 6:37 TERM 8
SELECT: 9-			
1. Set Up Supporting Info (if needed)	11. Post Beginning Stock Quantities		
2. Set Up the Control Record	12. Enter Beginning Serial Numbers		
3. Set Up Customer Ship-To Addresses	13. Enter Stock History Info		
4. Set Up Misc. Customer Charges	14. Enter Beginning LIFO/TIFO Layers		
5. Set Up Location Information	15. Set Up Conversion Units of Measure		
6. Set Up Product Categories			
7. Set Up Your Stock Item Information			
8. Print Inventory Cost Worksheet			
9. Load Beginning Stock Quantities			
10. Print a Stock Quantity Edit Listing			
<F1>Calc <F2>Cal <F3>ColD <F4>Xref <F5>Mess <F6>Stat <F7>Help <F8>End			

To install and configure a *SouthWare* module, you proceed sequentially through each option in this checklist-style menu.

SouthWare 3.0		Round City Appliance	AR-84-82-81
Customer Collection Maintenance		Enter Key	TIME 87:42 TERM 8
CUST#	1 Jayhawk Scientific Services	CONTACT	Rose Navroo
TERMS 2/10 NET 30	CBD LIMIT	4,888 RATING	TYPE OPEN ITEM
DOC # DATE DUE	AMOUNT DUE	ORIGINAL AMOUNT	DAYS CALL DATE COMMIT DATE
34 8/82/87	1272.00	1272.00	33
188 5/31/87	1358.00	1358.00	96
158 7/81/87	2485.78	2485.78	65
CURRENT	30 DAYS	60 DAYS	OVER 60 DAYS
.00	.00	1,314.47	3,573.78
BALANCE		4,888.17	OPEN CREDITS
			262.00CB
CALL DATE	SPOKE TO	STATUS	NEXT REVIEW
CONVERSATION: _____			
OPER: _____			
* (CRD to Search by Customer Name)			
Customer has No Active Conversation, Select Anyway? Y			

The Customer Collection Maintenance screen, a unique feature, helps you structure your collection process by letting you review customer data and take notes on your contacts. This screen allows you to record the date of contact, the operator placing the call, the person contacted, a three-line comment, a user-identified status field, and the next review date.

use these fields, for example, to store information about delivery of goods; then, using *SouthWare's* ReportMate module, you can generate a printout when it's time to evaluate vendor performance. These fields cannot, however, be used for pro-

cessing within the Accounts Payable system alone.

ACCOUNTS RECEIVABLE Like the Accounts Payable module, *SouthWare's* Accounts Receivable can stand alone or

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operate with other modules—in this case, Inventory/Sales, Services Billing, and General Ledger. Accounts Receivable is similar to Accounts Payable in other ways: it lets you enter sales invoices, debit memos, and credit memos into a work file for batch processing; it updates the customer records immediately upon posting; it posts to the General Ledger only when a transfer is executed from the Accounts Receivable system; and it lets you define two fields within the customer record for special reporting.

SouthWare lets you keep tabs on your customers by labeling them as either "cash only" or "hold credit." This works particularly well with the Inventory/Sales module: any attempts to enter a credit order for a cash-only customer produces a warning message on-screen, which the operator can override if desired (no override is available for hold-credit customers). Another useful feature is *SouthWare*'s impressive ability to handle multiple sales tax combinations, providing information necessary for sales tax reporting to each taxing unit. This is becoming particularly valuable as more local governments enact their own sales tax provisions.

You'll really like the flexibility *SouthWare* provides in aging open-item customers. The program lets you define the specific aging periods and select an appropriate aging method, based either on the invoice issue date or due date. The system automatically calculates and records the average number of days between the issue date and the payment-received date for all open-item customers. You'll find a number of useful options for calculating finance charges on account balances, too: you can set both minimum charges and grace periods and can define two finance charge levels, imposing different annual rates on the portion of balances in excess of a specified amount.

For open-item-balance customers whose detail history is maintained, the system lets you reverse nonsufficient fund checks, canceling both the debit to the cash account and the credits/debits of the original distribution. To reverse a transaction, you enter the original receipt information with a negative check amount. You can then review the detail distribution and execute the entry.

SouthWare 3.0		Round City Appliance	IS-88-82
Maintain I/S Control Record		Change	TIME 06:44 TERM 0
1. LAST ORDER NUMBER	10	17. PRINT COMPANY ADDR. ON P. O.	Y
2. LAST PO NUMBER	0	18. PRINT HEADERS ON P. O.	Y
3. LAST INVOICE NUMBER	4	19. PRINT PRICE ON P. O.	Y
4. STOCK LEVEL CHECK?	Y	20. PRINT COMPANY ADDR ON PICKING	Y
5. INTERFACE FROM A/P?	N	21. PRINT HEADERS ON PICKING	Y
6. MULTI-LOCATIONS?	Y	22. WILL LIFO/FIFO COST USE USED?	Y
7. KEEP HISTORY?	Y	23. PRINT ASSEMBLY ON PICK TICKET	Y
8. USE P/O SYSTEM?	Y	24. PRINT ASSEMBLY ON INVOICE	Y
9. FILL ALL BACKORDERS?	Y	25. CASH DRAWER NUMBERS:	
10. POST CASH INVOICES TO A/R	Y	1 2	
11. P.O.S. CUSTOMER NUMBER	999999	----- CREDIT CARDS -----	
		TYPE DESCRIPTION	GL ACCOUNT #
12. PRINT COMPANY ADDR. ON INVOICE	L	26. A NASH SAVERS	1130-015
13. PRINT HEADERS ON INVOICE	Y	27. C CARTE BLANC	1130-014
14. NO. OF LINES TO PRINT ON INVOICE	50	28. M MASTER CHGR	1130-013
15. NO. OF LINES ON INVOICE FORM	66	29. A RIMERS CLUR	1130-012
16. PRINT SHIP TO ADDR. IN POS	N	30. U VISA CARB	1130-011

Enter Change Number --

In most integrated packages, the purchasing, receiving, point-of-sale, order entry, and inventory functions would take up four or five separate modules. But *SouthWare* packages them all together in the Inventory/Sales module. You use the Inventory/Sales record (above) to define the options you will use in the purchasing function.

SouthWare 3.0		Round City Appliance	XN-81
View Execute Information			TIME 06:53 TERM 0
Execute FINANCIAL SUMMARY AS OF 9/01/87 AT 06:49 AM			
CASH FLOW:			
CONSOLIDATED			
CURRENT C/L CASH BALANCE		28,733	
CASH DUE IN NEXT 30 DAYS		9,488	
CASH DUE OUT NEXT 30 DAYS		12,451	
PROJECTED CASH BALANCE ON 10/01/87		17,690	
----- SUMMARY AGING -----			
CURRENT	1 - 30 DAYS	31 - 60 DAYS	OVER 60 DAYS
ACCOUNTS RECEIVABLE	5,489	1,272	42
ACCOUNTS PAYABLE	00	00	2,500
			1,001
PROFITABILITY:			
CURRENT PERIOD	YEAR-TO-DATE	YTD BUDGET	CURRENT BUDGET
SALES	00	424,787	694,808
PROFIT	00	33,689	77,120
			3,089
RATIOS: CURRENT = 1.01 PROFIT/EQUITY = .64 PROFIT/SALES = .00 1 1 1			
PRESS FUNCTION KEY: (F1) Zoom Cash (F2) Zoom Bal.Sheet (F3) Zoom Profit/Loss (F4) Zoom Ratios/Triggers (F5) Profit Center (F6) Print (F7) Help (F8) EXIT			

The *ExecuteMate* Financial Summary screen summarizes financial data for your review. The first screen of *ExecuteMate* automatically shows your projected cash for the next 30, 60, and 90 days, along with a summary aging of receivables and payables—useful figures for the entrepreneurial manager. Using function keys, you can zoom in for a look at the account total details.

SouthWare's Accounts Receivable also shines in its sales tracking and commission calculation elements. The system will calculate commissions on either issued or paid sales invoices; the commission rate

can be applied to gross profit or gross sales. If you enter a base-year sales figure when setting up, *SouthWare* will calculate commissions only on sales in excess of that amount.

COLLECTION AGENT We especially liked *SouthWare's* add-on option that provides additional fields in the customer record file for details on collection activity. You can record the date of contact, the operator placing the call, the name of the person contacted, a three-line comment, a user-identified status field, and the next review date. To facilitate follow-up assignments, *SouthWare* will generate standard collections reports combining regular customer activity (including customer contact and phone number) with collection history. The follow-up operator can also interactively display the same information to the screen and efficiently update the customer's file. And *SouthWare* helps you implement an effective collection review policy by letting you access records by review date, aging date, number of days past due, customers over their credit limit, collection status flag, or any combination.

INVENTORY/SALES In most integrated packages, purchasing, receiving, order entry, point of sale, and sales analysis take up four or five separate modules. *SouthWare* packages all of these functions into a single, easy-to-install module called the Inventory/Sales Dual Edition. Most retailers, distributors, or wholesalers would probably find it a valuable combination.

SouthWare's purchasing functions mesh neatly with its Accounts Payable module. The program helps establish inventory clearing accounts for your product categories and handles basic functions for multilocation businesses. Moreover, *SouthWare* will record the part number used by each of your vendors for any item that you stock, thereby reducing the time required to prepare purchase orders. Other features include a period-to-date back-order count and an order count maintained on the stock record.

Unfortunately, the purchasing functions fall short in a few spots. *SouthWare* gives you no explicit means for recording or calculating lead time, safety stock, safety factor, average use, minimum order quantity, recommended reorder levels, and economic order quantity. It also won't help in identifying inventory according to ABC-analysis criteria. Although stock status, sales analysis, and a purchasing advice report do provide part of the informa-

tion essential to effective inventory management, some comparable packages go further in assisting you in this area.

The Inventory/Sales module supports multiple receiving locations, either through remote terminal connections or manual transfer. In addition, *SouthWare* will soon release a Branch Office module that will let you transfer data between the central and branch offices for updating in-

■ *SouthWare* will record the part number used by each of your vendors for any item that you stock, thereby reducing the time required to prepare purchase orders.

ventory and sales figures. As with Accounts Payable and Accounts Receivable, the stock files can contain user-defined fields—up to three of them, each of which can take information up to six characters in length. Using these fields and the Report-Mate module, you can record and report additional information. This facility has no edit controls, however, and therefore no automated way to ensure that the data entered is valid.

Serial numbers can be recorded upon receipt of goods, and these serial records provide several options to help you actively manage your stock, minimize carrying charges, and improve warranty tracking. Certain retail environments, for instance, should find *SouthWare's* "floor-planning" features helpful: the program lets you note the vendors who will be charging flooring credit and the date charges will begin on inventory items. Assembly and payment information is also carried on serial records. Consigned goods can be handled by using separate product categories and General Ledger account numbers. The system will accept input from a bar-code scanning device, which can increase accu-

racy and reduce key entry time in preparing order invoices. *SouthWare* will also print shelf/item labels, providing bar codes for the stock number if desired.

LIFO, FIFO, AND FISH *SouthWare's* receiving program is quite comprehensive in its treatment of inventory costs, supporting the seven most common methods: last cost, average cost, standard cost, last in/first out (LIFO), first in/first out (FIFO), first in/still here (FISH), and actual serial cost. For average cost, *SouthWare* keeps a weighted moving average of serial items. Up to ten cost layers can be maintained for LIFO or FIFO. The user would enter the standard cost, and actual serial cost would be cost per item recorded by serial number. In the case of FISH, the software provides tools (such as options for conducting a physical inventory and for recording inventory valuation adjustments) to identify idle inventory that may need adjustments to the carrying values.

The point-of-sale functions in the Inventory/Sales module allow for cash sales, credit card sales, credit hold, layaways, stock searches, cash drawer number, and department operator codes. This is a case in which Xenix on a fast AT would be appropriate for performing multiuser functions, such as recording over-the-counter sales while running the accounting functions.

At the heart of *SouthWare's* Inventory/Sales module is a solid order-entry component. In addition to standard orders, it can process transfers between locations or orders to be drop-shipped from your supplier to your customer without affecting your inventory. We found a lot to like in this program. It can issue quotes and transform them into orders without being rekeyed. It lets you place a free-form comment on the invoice. It supports ship-to codes, with up to 99 different ship-to addresses for each customer. And it can print a variable number of shipping labels for orders, when shipments require more than one package.

A few other aspects of the Inventory/Sales module are worth mentioning. The software's tax calculations include line-item sales-tax cutoff amounts—applicable in states, such as Texas or Tennessee, that impose a limit on the amount of

■ THE PRICE WATERHOUSE REPORT

The Price Waterhouse Team



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sales tax charged on a single item. Once an order is entered, a "package" discount can be allocated automatically over the different line items—an unusual option that can be quite handy in certain whole environments. Another potentially helpful Inventory/Sales component was not yet released when we reviewed the package: a United Parcel Service shipping module. This module will maintain UPS rate tables, calculate costs, produce the proper number of box labels, and print a UPS manifest. Finally, for system security, the Inventory/Sales module lets you limit the ability of an operator or terminal to override prices or costs. A management exception report shows the operator's price/cost overrides for you to review for compliance with company policy.

LOTS OF EXTRAS In addition to the standard accounting modules, *SouthWare* includes a number of extra features. Notable is the ExecuMate module, which provides a summary of "executive" information—key financial and management data—either on-screen or in hard-copy reports. To check out how your company is doing, you simply identify the account ranges for your cash, assets, liabilities, and equity accounts and process the data calculation as of the date you wish. The screen summarizes the data and presents items for your review. Using function keys, you can zoom in to get the details behind the summary numbers. ExecuMate also lets you view and compare information for different levels in your organization.

In designing this module, *SouthWare* Innovations has thoughtfully emphasized the information most useful for managers who like to keep their finger on the pulse of operations. The first screen of ExecuMate automatically shows your projected cash for the next 30, 60, and 90 days, along with a summary aging of receivables and payables. This will help the entrepreneurial manager take action quickly; accountants, too, will welcome the ease with which this information is extracted and presented.

Other modules are available for specialized operations. *SouthWare*'s Assemblies module, similar to a bill-of-materials module, lets you keep track of the creation of stock items assembled from other stock items. The module can generate a requirements report showing the number of items that can be made from available stock and what parts would need to be ordered to create additional items. The Services Billing module is for businesses that have recurring receivables with contracts—for example, exterminators who need to track multiple services per work order, record standard problems, and keep track of both scheduled and on-demand work.

The Payroll module, which can be integrated with the General Ledger or can stand alone, is suitable for both hourly and salaried workers. Its tax code capability is sophisticated enough to handle the different income tax schemes used by most states and counties, whether they calculate taxes based upon federal rates or under their own schemes.

■ The tax code capability of *SouthWare*'s Payroll module is sophisticated enough to handle the different income tax schemes used by most states and counties.

SouthWare also includes an easy-to-use report writer program, ReportMate, that takes full advantage of the software's variable account number formats. Report output options include both .DIF and *Word-Perfect* file formats; .DIF files can be used to import data into most spreadsheets and databases, including 1-2-3, Excel, Paradox, and dBASE III.

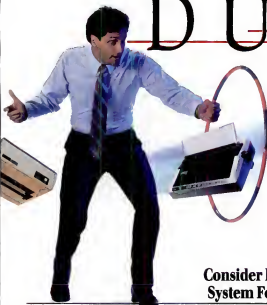
KEEPING TABS *SouthWare*'s security and system logging feature, one of the more advanced we've seen for a PC-based accounting product, should warm the hearts of most auditors. The system administrator can give users log-on IDs with different menu rights, as well as rights to use only specified terminals. The system administrator can thus restrict certain functions to locations with additional physical security. Furthermore, *SouthWare* will keep a selective log of user activity, to track system utilization and maintain a primary audit trail. Also included is an internal electronic mail system that lets you send yourself reminders when processing at different menus or send messages to other users that they receive when they log on to the system.

Taken together, this is an admirably designed, well-implemented package that should easily handle the essential accounting chores of most small businesses. If your needs are sophisticated and your growth plans ambitious, you should definitely consider *SouthWare*.

—G. William Dauphinais, Timothy J. Lee, and Barbara J. Mullins

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Imagine that instead of creating a monstrous single file of data, you can create logically linked files that pull related data from one to another, saving you time and keystroking, and preventing errors from redundant data entry. You don't have to program, but you **can** create macros.



Move data from file to file automatically by linking up to 10 field pairs. Here a unique account number links the Client File to the Order File, and a Product Code links the Product File to the Order File.



Create customized layouts to suit your information needs and fit your business forms. Here are two layouts in one file: an Order Entry Screen and an Invoice to fit continuous-form paper.



Format data as you wish, including optional use of dollar sign and number of digits in numbers, left and right justification of data, and five ways of displaying the date.

Nutshell Plus is features-rich. With it, you can also:

- Create a form letter in a field
- Print to screen to preview the exact appearance of your data
- Insert the current date and time with one keystroke
- Change field type
- Eliminate empty space between and within records when printing
- Preset data to avoid rekeying of repetitive data
- Use the exponentiation operator in calculation

formulas

- Read files you created with Nutshell, its flat-file cousin

Visit your nearest retail dealer and try the **Nutshell Plus** Guided Tour Disk, then buy **Nutshell Plus**. At \$295 we think you'll find a lot to like.

For the name of your nearest dealer carrying **Nutshell Plus**, call the Canterbury International Sales Office at 1-800-637-8385 (outside of Massachusetts) or (617) 881-7404 in state.

Nutshell Plus runs on the IBM and IBM-compatible PC, XT, AT, and PS/2s. It requires 384K and DOS 2.0 or higher. Nutshell is a registered trademark of Nashoba Systems, Inc.

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COMDEX/Fall '87
November 2-6, 1987
Bally's Hotel, Booth B824
Las Vegas, Nevada

DBASE Report Writers: *A Better Way*

Inspired by the weaknesses of market giant dBASE, a number of vendors are marketing sophisticated tools for dBASE users: report writers more capable than dBASE's own. Here's what we found when we examined ten of these programs.

Ash-ton-Tate's *dBASE III Plus* dominates the PC database management system market despite some serious flaws. The database's market share is in the mid to high 40s, placing it within range of generating more sales than all the other products in its category put together.

But *dBASE*'s weaknesses, especially in report writing, rival its strengths, leaving a gap that third-party software developers have rushed to fill. The market now includes a number of valuable programs that let you define reports far more complex than *dBASE* can handle. We examined ten of these programs for this article.

PRIMITIVE ART To evaluate these products, we first looked at *dBASE*'s limitations. We found that although every new release of *dBASE* has improved the system's report-writing features, even the newest *dBASE III Plus* report writer is primitive by today's standards.

dBASE basically offers three methods of extracting information stored in its files.

At the low end of the scale, to output data in more or less unformatted form—to your printer if you wish—you type *dBASE* commands at the notorious naked dot prompt. This method is useful for little more than seeing what's in the files.

At the opposite end of the spectrum, you can develop magnificent reports of any imaginable style and complexity—if you learn the intricacies of the *dBASE* command language. Experience in programming other languages and a highly analytical mind are handy adjuncts. As a high-level language, *dBASE* can perform some functions in one or two lines that might take a page of code in other languages, but the software has a deserved reputation for quirkiness. Even if you do master the zigs and zags, programming an elaborate report is time-consuming and expensive.

The middle ground between outputting data with the commands and programming with the command language is using the internal report generator. The *dBASE III*

■ REPORT WRITERS

Plus Report Generator lets you prepare simple headers, define groupings based on field changes, adjust the page layout, use dBASE functions to build expressions (assuming, of course, that you know how)—and that's about it. The user interface gives you some help: Framework-style drop-down menus and dialog boxes.

Since one of dBASE's claims to fame is the relational, multifile nature of its data management facilities, it's surprising that the internal report writer is basically a single, flat-file system. You can jury-rig limited access to more than one file, but the method is neither obvious nor discussed in the documentation.

dBASE III Plus also includes a simple label-generation routine. You can print multiple labels across a page, but dBASE handles labels of differing lengths incorrectly in this mode.

THREE TYPES The search for improved report-writing capabilities using dBASE data files led us to a variety of programs that can produce reports from such files. While some of the report writers are themselves complicated, others let you create sophisticated reports with hardly more complexity than dBASE's own crippled report writer.

We looked at three basic types of report writers. Three of the ten programs we review here are dBASE-specific report writers, aimed directly at the weaknesses of dBASE's report creation tools (dNPL/Reporter, Quickreport for dBASE, and R&R Relational Report Writer). Three of the programs (Intelligent Query, Reports Plus, and Snow Report Writer) are more general report generation tools, not limited to dBASE files; they can access a variety of data formats from spreadsheets, high-level languages, and various other means of data storage. Finally, we examine four more-or-less freestanding data management tools, which can access dBASE data files and integrate them into their own data manipulation schemes (Alpha/three; Form-Manager II; PC/Focus, which includes PC/Focus dBASE Interface; and RAM-ISI/PC Workstation, which includes PC/Reporter).

Report writers have matured. They are now valuable adjuncts to dBASE, generally appealing to one of two groups. The first

group includes dBASE users who need attractive and perhaps intricate reports but who either don't know how to program them or don't have the time. The second group includes applications developers, who can save time and money by using a report generation tool instead of programming. A few of the programs reviewed here can even meet the needs of both camps.

And we found that the level of flexibility and power the report writers offer doesn't always correlate with cost. They range in price from \$89.50 to \$695.

The capabilities of the programs reviewed here vary significantly. While most are relational, meaning that you can include data from multiple files in your reports, some are limited to working with data from a single file only. Some of the relational report writers let you include data from only one other field in another file ("one-to-one"); others let you link data from one record to data in records in a number of other files ("one-to-many").

dBASE and third-party compatible languages do not always use the same internal structure for index files. FoxBASE Plus and Clipper, specifically, use different index systems. If you use one of these systems, you should be sure that the report writer you choose can utilize its special index files.

Most report writers allow you to perform sorting functions within the report writer, which helps you organize your reports exactly the way you want them without altering your data files. Similarly, you can usually group records together, placing header and footer text and summaries before and after each group. The number of sorting and grouping levels varies from one program to another, but only unusually complex reports require more than a handful of levels.

Some report writers have special provisions for generating mailing labels in various formats, and a few include fill-in-the-blanks form-letter systems. Some let you draw boxes, use printer attributes like boldface or italics to dress up your reports, wrap words so that you can print long fields correctly in a limited space, or define title pages and report summaries that can precede or follow the body of the report itself. Some of the programs we tested can

access only dBASE data files, while others can extract or import data from a wide variety of data formats. Other features that various packages offer are the ability to enter and edit data, and telecommunications options that let you connect to mainframe computers and transfer data more easily than you could with general-purpose modem software.

With rumors of a new dBASE release in the air, we should soon see whether Ashton-Tate has a report writer standing in the wings that's worthy of the name dBASE. In the meantime, the programs onstage now, which are reviewed in alphabetical order by product name, will do the trick.

Alpha/three

Alpha/three, from Alpha Software Corp. for \$395, is a complete database manager that has garnered high marks in PC Magazine's Project Database reviews. Because many of its users are enthusiastic about its report-writing capabilities, we decided to see how it stacks up against the standalone report writers evaluated here.

Alpha/three uses the same database and index structures as dBASE III/III Plus; the same data and index files are fully usable in both programs without conversion or translation of any kind. Alpha/three even accesses dBASE memo files.



FACT FILE



Alpha/three,
Version 1.0
Alpha Software Corp.
One North Ave.
Burlington, MA 01803
(617) 229-2924
List Price: \$395

Requires: 320K RAM,
two disk drives (hard disk recommended),
DOS 2.0 or later.

In Short: This impressive menu-driven database manager is easier to use than dBASE III or III Plus and offers report-writing power as well as database management power. Not recommended as a standalone report writer to use with dBASE because of the price, but it can share files with dBASE without the need for importing or conversion. Not copy-protected.

CIRCLE 630 ON READER SERVICE CARD



dBASE Report Writers:

Summary of Features

(Products listed in ascending price order)



R&R
Relational
Report
Writer
\$149.00

Reports
Plus
\$149.95

Quick-
report
for dBASE
\$295.00

RAMIS/PC
Workstation
\$375.00

Alpha/
three
\$395.00

Intelligent
Query
\$500.00

Snow
Report
Writer
\$695.00

PC/Focus
dBASE inter-
face with PC/
Focus,
Release 3.0
\$1,490.00

RELATIONAL

Number of one-to-one files	16	N/A	10	N/A	6	12	N/A	Unlimited	Unlimited	16
Number of one-to-many files	16	N/A	10	N/A	6	12	N/A	Unlimited	Unlimited	16
Accesses dBASE memo fields	○	○	●	○	○	○	●	●	●	○
Can use dBASE indexes	○	○	●	○	●	○	●	●	○	●
Can use Clipper indexes	○	○	●*	○	●	○	○	●	○	○
Can use FoxBASE Plus indexes	○	○	●*	○	○	○	○	○	○	○

SORTING

Number of levels	10	3	6	6	16	Unlimited	None	Unlimited	7	32
Ascending and descending	●	●	●	●	●	●	○	●	●	●

GROUPING

Number of levels	10	3	6	5	16	Unlimited	3	Unlimited	9	5
Group headers	●	○	●	●	●	●	●	●	●	●
Group footers	●	○	●	●	●	●	●	●	●	●
Mail labels	○	●	●	○	○	○	●	○	●	○
Form letters	○	○	●	○	○	○	●	○	●	○

FORMATTING

Line/box drawing	○	●	●	○	●	○	●	●	●	○
Printer attributes										
Bold, italic, etc.	○	○	●	○	●	○	●	○	●	○
Fonts	○	○	●	○	○	○	●	○	●	○
Report headers	●	○	●	○	●	○	●	○	●	○
Report footers	●	○	●	○	●	○	●	○	●	○
Word wrap	○	○	●	○	○	○	●	○	○	○

OTHER ACCESSIBLE DATA FORMATS

WKS	○	○	○	●	○	○	●	●	●	○
WK1	○	○	○	●	○	○	●	●	○	○
SYLK	○	○	○	●	○	○	●	○	●	○
DIF	○	○	○	●	○	●	●	○	●	○
Fixed ASCII	●	●	○	○	○	●	●	●	●	●
Variable ASCII	○	●	○	●	○	●	●	●	●	○
Other	○	○	○	○	○	●	●	●	●	●

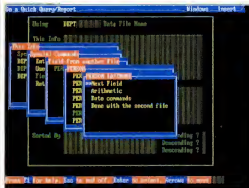
MISCELLANEOUS

Data entry/manipulation	○	●	○	○	○	●	●	○	○	●
Telecommunications	○	○	○	○	○	●	○	○	○	●



—Indicates Editor's Choice ●—Yes ○—No *The R&R Relational Report Writer can use Clipper and FoxBASE Plus indexes with the optional Clipper and FoxBASE Plus module.
N/A—Not applicable; does not have this feature.

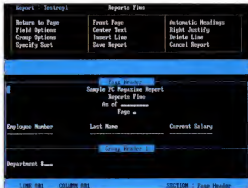
CREATING REPORTS FOR dBASE



Snow Report Writer's Quick Query function offers a way to format and perform a report in one step. Using this option, you can send output to the screen, a printer, or a file. At the bottom of the screen, you'll find a line that indicates the function key options available at any given time.



RAMIS PC/Workstation's PC/Reporter module offers a menu-driven approach to report definition. Multiple choice and text entry windows solicit your input, while clearly defined function keys at the bottom of the screen provide you with a number of options, including Help and View Report.



The Reports Plus report page is divided into sections, such as Page Header and footer, detail lines, and report footer. If you create subtotalling groups, you'll also get group headers and footers. The program lets you create a front page of organized text and sort data on up to five fields.



With Alpha/Three, you can design an input form for entering data and use that same form for output. If you position your fields carefully, you'll find this to be a handy way to output data to a preprinted form. Function keys located at the bottom of the screen alert you to your various options.

The interface is much friendlier than that of *dBASE* or, for that matter, many other database managers. Unlike *dBASE*, which is essentially command driven, *AlphaThree* is heavily menu driven. You select the option you want from a variety of menus, including normal text menus, horizontal menus, and pop-up menus. They offer unusually easy viewing, browsing, and editing, and you can readily change screen layouts and other attributes of the display. Function keys also call various options.

USEFUL FEATURES *AlphaThree's* many useful, convenient features include excellent field validation and control provisions. You can apply these provisions to data entered, both to format the data and to assure that it meets your specifications. Included are range checking, lookups, defaults, field-by-field prompts, calculated fields, and more.

You can design an input form for entering data and use the same form for output. If you position your fields carefully, this method can be handy for outputting data to a preprinted form. You paint the entry form on an empty screen, using up to seven screens for complex forms. Some of the editing is a little rough; *AlphaThree* doesn't let you move fields around from line to line and doesn't offer cut and paste.

AlphaThree's label-printing routines are simple to use yet effective. You can print labels up to six across, adjusting the overall print dimensions to fit any kind of label. One nicety—difficult to obtain even with *dBASE* programming, and lacking in many report writers—is the ability to print labels with different numbers of lines, even in multiple-across format. For example, if you have fields for a second address and the recipient's company and title, you can generate labels with as few as three lines (no company, no second address, and no title) or as many as six lines. *AlphaThree* wisely doesn't print the empty lines, even when printing labels two to six across.

Using the program's report writer is much like designing an input form. You position text and fields on an empty screen. Only three levels of grouping are permitted, as compared with the six, eight, or more allowed by many of the standalone

report writers, but three levels is likely to be sufficient for the lion's share of reports.

AlphaThree distinguishes between the header area and title area. Both segments print at the top of each page, so the distinction seems rather unnecessary. The layout of the report screen resembles that of many other report writers, with the various segments of the report definition separated by lines. When you first start designing a report, the program offers you the choice of Quick Setup or Custom Report. The Quick Setup option creates a canned columnar report definition as a starting point. Ultimately, you can do whatever you want with either option, but the Quick Setup gets you started a little faster.

UNUSUAL FEATURES Either way, the report definition process is straightforward. The *AlphaThree* report writer has some unusual features, such as control over whether or not to print blank lines in your definition, the ability to add extra blank lines for clarity, variable field justifications, access to print attributes like bold-face and italics, and the ability to convert numbers to words for applications like check writing. You can use its more than four dozen *dBASE*-like functions for complex data manipulations.

Perhaps the most interesting feature is the program's distinction between the length of a field and the window in which it prints. If you define the window's length shorter than the field length, *AlphaThree* will output the field on multiple lines. It even word-wraps the output automatically—one of the cleanest methods of managing long fields we've seen.

AlphaThree also includes a powerful and useful form-letter system that accesses your database for fill-in-the-blanks form letters. A simple full-screen editor lets you enter the text of the letter, or you can use your own editor or word processor if you prefer. You can skip empty fields, prompt the operator for input at print time, define equations, include external disk files, and control text with conditional statements.

IMPORT/EXPORT *AlphaThree* can import (and export) data from 1-2-3, Symphony, SYLK, *dBASE II*, DIF, PFS, or either variable-length delimited or fixed-position ASCII data files. As mentioned

earlier, the program can access *dBASE III* files directly—with no importing or conversion necessary. This flexibility lets you use its report-writing facilities with a wide range of other programs.

The *AlphaThree* report-writing functions are all flat, in that they have no provisions for accessing more than one data file. *AlphaThree* itself has a posting system to update a data file with information in a second file, and a method of joining, intersecting, or subtracting two data files to create a third data file.

These systems take *AlphaThree* out of the realm of purely single-file database managers, but not all that far. Given the lack of relational commands in the report writers, you must learn how to use the post-or-join systems before you work with the resulting file in the report writers. This method is far less flexible than that of a true relational report writer.

AlphaThree's report generation capabilities are superior in flexibility and ease of use to those of *dBASE III Plus*. At \$395 retail, though, you won't want to buy *AlphaThree* solely as a report writer. Other products offer more report-writing power at less than half the price.

Nevertheless, *AlphaThree* is a pretty impressive database manager in many respects. It merits consideration by users who are not inclined to learn the complexities of *dBASE* and who want report-writing power as well as data management power.

dNPL/Reporter

Database Applications advertises its \$89.50 *dNPL/Reporter* as a "Fourth Generation Relational Report Writing System." The fourth-generation appellation is pretty heady stuff for a low-priced report writer, so we were curious about how *dNPL/Reporter* lives up to its billing.

Unlike most of the report writers reviewed here, *dNPL/Reporter* is command driven rather than menu driven. The program's user manual recognizes that menu-driven systems are "convenient and popular," but it suggests that learning the *dNPL/Reporter* system will pay dividends over time.

You operate *dNPL/Reporter* by typing keywords that are clearly derived from the

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ASHTON-TATE

dBASE III PLUS

the data management standard



FACT FILE



dNPL/Reporter,
Version 3.1
Database
Applications Inc.
400 Wall St.
Princeton, NJ 08540
(609) 924-2900
List Price: \$89.50

Requires: 256K RAM, two disk drives,
DOS 2.1 or later.

In Short: A different approach to dBASE report writing, this command-driven program handles multifile relations easily, gives you fine conditional control over your data, and accesses dBASE files, but it requires more "programming" than many users prefer. Not copy protected.

CIRCLE 638 ON READER SERVICE CARD

Focus-RAMIS camp. You must spell out all keywords; the program accepts no abbreviations. This conscious design decision improves readability, but spelling everything out becomes tiresome, especially when the keywords are as long as **COLUMNTOTAL**. You can truncate the field names (as long as the truncation is unique) to reduce repetitive typing.

Although field names can include imbedded spaces, no spaces are allowed in **dNPL/Reporter** commands. You must use an alias instead, which can require looking at the alias list more often than should be necessary. Perhaps it would be better if the program allowed quoted field names, like "YRS EDUCATION." It would also be handy if the program could repeat whatever command you had just entered, as **dBASE** does, so you could make minor modifications to a statement to correct or fine-tune the output.

Many of the keywords have synonyms for better readability and ease of entry. The program uses the \$ character as a text wildcard, which seems idiosyncratic and non-DOS-like compared to a simple ?. Similarly, descending sorts are indicated by the keyword **HIGHEST**, instead of something like **DESCENDING**.

ODDEDITOR **dNPL/Reporter** calls the process of defining a selection criterion and filtering records *screening*—an apt

term. The language orientation makes using conditional statements a reasonable option.

You can store command sequences in "exec" files. The system includes an idiosyncratic editor. It can get the job done, but in these days of near-standardization of simple editors for the PC, the oddity of the **dNPL/Reporter** editor is most unwelcome. Fortunately, you can use your own editor or word processor if it will fit in memory while **dNPL/Reporter** is running; you just execute it from within **dNPL/Reporter**.

You can include "amper-variables" (which look like **dBASE** macros—for example, "&department") in an exec file to prompt you for a value when the report is printed. You can thus use the same report definition for different departments, for instance, or from month to month. You can also create simple menus.

dNPL/Reporter has two forms of linking commands. Matching creates a temporary link between two files for use in one report, and Join forms a link that exists until cleared. The linked field in the child file must be indexed, and the program will do this for you. It appears that both forms of linkage are virtual since no permanent disk file results.

FILE ACCEPTANCE **dNPL/Reporter** works equally well with **dBASE III/III** files and straight-fixed-position ASCII data files (it won't work with variable-length, non-fixed-position ASCII files). It discerns the field names in a **dBASE** file from the header information, but you have to tell the system about the field structure in an ASCII file. **dNPL/Reporter** doesn't work with spreadsheets or data files from other programs and applications.

The large number of keywords lets you produce tabular reports with horizontal as well as vertical breaks, including totals in both directions. You can apply the simple sum, count, average, and other statistics similarly.

The program lets you define variables to store elements not already in your databases. You must assign FORTRAN-like format codes to each variable, though, and this complication seems unnecessary in many cases. We wonder how nonprogrammers will be able to handle variables and F10.2 formats.

COMPUTATIONS As befits a language, you can execute computations. An if-then-else construct is available to modify the way you want the program to perform a computation. You can set a slew of system variables to change defaults and fine-tune the program.

You can convert a **dBASE III** file to ASCII and vice versa, applying the various **dNPL/Reporter** filters along the way to modify or restrict the data converted. This feature offers some flexibility, but **dBASE** itself can handle most normal conversions directly.

In addition to the nonprocedural command, **dNPL/Reporter** includes more traditional procedural programming statements, including **DO** and **REPEAT**. . . UNTIL loops, subroutines, CASE constructs, indexing, and conditionals.

We were able to access our test **dBASE** data files with no difficulty, and relating the various files proved easy too. The basic **dNPL/Reporter** keywords are easy to learn, although novices will find mastering the more advanced programming commands difficult. We were able to produce reasonably attractive reports, but many other programs tested here can produce more-elegant reports, often with less effort.

The system is appealing, and we can see how the complete system, including data entry and manipulation commands, could be an attractive alternative to many full database management programs. Yet despite the vendor's contention that the system doesn't involve programming, this assessment depends on how you define the word. Many users will prefer programs that do more of the work for them.

dNPL/Reporter, although not our preferred approach to **dBASE** report writing, is unquestionably a lot of software for its low price. It handles multifile relations easily and offers fine conditional control over your data. And it accesses your **dBASE** data files painlessly and smoothly.

FormManager II

BIT Software's \$99 **FormManager II** is a combination product that offers several data management facilities. Structured into discrete modules, **FormManager II** includes a forms editor, which creates and

designs forms; a Create Data File program, which creates data files in either *FormManager II*'s own format or *dBASE III* format; a data file manager, which enters and manipulates data; and a report writer.

These functions thrust *FormManager II* into the low-end database manager category. Unfortunately, the system is a flat-file manager, so it can't handle relational linkages among multiple data files. This limitation severely hampers the report-writing functions.

The traditional menu-driven interface relies on function keys and Alt sequences rather than fancy windowing. It's neither as flashy nor as easy to learn and use as more modern approaches.

Two much-needed keyboard templates come with the package; they're necessary because the meaning of the function keys and Alt-key sequences changes in different parts of the program.

Form entry is straightforward. Basic-

ly, you paint the screen and then fill in a dialog box with the characteristics of the fields. You can create boxes to dress up your form and to separate parts of the form, but you can draw only single boxes.

TWO FIELD TYPES *FormManager II* differentiates between two types of fields—single or repeating. Repeating fields have the same name as other fields on a form; they're distinguished by subscripts. *FormManager II* calls these subscripts index numbers, which is likely to confuse those who associate indexing with keys, sorted orders, and the like. An example is a form with room for ten product codes; each one is a separate repeating field in *FormManager II*.

The program provides field types for social security and phone numbers and for times, as well as the normal alpha and numeric field types. Auto-incrementing fields are available for, say, consecutive

invoice numbers. You can specify a range of permissible numeric values, default values to save repetitive typing, and automatic insertion of the current date and time. And you can assign screen attributes, including color. There's also a confusing code attribute. You can edit some attributes of a field you've already defined, but if you want to change the length, you have to delete the field and go through the complete definition process again.

CALCULATING You must specify calculated fields using *FormManager II*'s programming language. Calculating a total, for example, uses a DO loop construct and subscripted array—likely to be beyond many beginners. The purpose of report writers, at least in the *dBASE* environment, is to circumvent programming. Another annoyance is that the calculated fields don't recalculate and display until you press a function key.

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■ REPORT WRITERS


FACT FILE



**FormManager II,
Version 3.3**
BIT Software Inc.
830 Hillview Ct., #160
Milpitas, CA 95035
(408) 263-2197
List Price: \$99
Requires: 256K RAM,
two disk drives (hard disk recommended),
DOS 2.0 or later.

In Short: This combination data manager and report writer lacks relational report writing as well as an elegant, polished interface; as a dBASE report writer, it doesn't stand up to the others reviewed here. Not copy protected.

CIRCLE 637 ON READER SERVICE CARD

Each field in your file appears on a printer specification form when you create a print specification. You can change the row and column of each field, which might be helpful in positioning fields on a pre-printed form. And you can assign a printer attribute to each field, but only by entering the precise-decimal printer control sequences. This method is well beyond the skills of most users. Even if you know the codes, you must enter them for each field to which you wish to apply a print attribute—a laser printer user's nightmare. The program should handle such details through an installation system.

WRITING REPORTS The report writer module itself is simple and not terribly powerful. You can supply a single title line, define selection criteria to include a subset of your records, sort on up to three fields, and calculate subtotals, totals, averages, and counts—that's all.

FormManager II's programming language supports 26 scratch variables; arithmetic, trigonometric, statistical, and string functions; simple conditional statements; and one simple loop construct. A program can't be longer than 50 lines, which limits the complexity of what you can accomplish. BIT Software refers to programs as macros, perhaps to indicate their somewhat limited nature.

FormManager II performed as advertised in relation to *dBASE III*. It created le-

gal and usable *dBASE* data files from forms, and it read and manipulated *dBASE III* DBF data files in our tests. If you use repeating fields in *FormManager II*, it appends the subscript to the field name when creating a *dBASE* file (ITEM1, ITEM2, ITEM3, and so forth). This course of action is reasonable and works well. The only restriction is a 128-field limitation, which could be a problem if you specify a lot of repeating fields on a long form.

The documentation is acceptable, covering the program's features in adequate detail. A decent tutorial comes with the program, although a few typos and errors could befuddle beginners.

FormManager II does what it sets out to do, but as a report writer, it doesn't set out to do as much as most of the other programs reviewed here. The lack of relational report writing is a tremendous drawback, and the program's interface lacks elegance and polish. Its forms orientation might override these factors if you do a lot of forms work, and at \$99 it's not terribly expensive. But if you're looking for a *dBASE* report writer, look elsewhere.

Intelligent Query

Intelligent Query, from Programmed Intelligence Corp. for \$500, is a report writer aimed primarily at vertical-market software manufacturers. It can help software vendors reduce their development time by eliminating the need to develop such a tool on their own. About 150 heavy-hitting firms customize and offer versions of this program, including TLB (*Solomon III*), Peachtree Software, Construction Data Control, Micro-MRP, and Charterhouse Software Corp. An uncustomized generic version is available to individual end users, and new versions for end users should be on the market by the time you read this issue (more on them below).

Programmed Intelligence says that *Intelligent Query* is based on artificial intelligence techniques. The company has positioned the program as a tool to help you analyze information and create queries and reports, as well as simple graphs. The program's designers claim that it is "so easy to use that first-time and casual users don't even need a manual." We think this may be understandable software developer hy-

perbole, but *Intelligent Query (IQ)* for short) does have some interesting features.

Almost all *IQ* messages and prompts appear in little pop-up windows, which show up all over the screen. The logical flow is good, and the system operates intuitively at this level.

Pop-up prompts lead you through the process of specifying queries and reports. As you define requests, the program builds a series of English-like commands in its internal language. If you learn this language, you can also type the commands directly from the keyboard—likely to be a somewhat faster method for experienced users.

The *IQ* language, which has some 130 reserved keywords, appears to be a flexible and powerful query language. Unfortunately, the manual doesn't explain all of the keywords individually. You can intuit what many of them do by observing how the menu system uses them, and the manual explains some rather casually. Still, a reference section in the manual should explain them rigorously.

REPORT PAINTING You can paint a report, using satisfactory editing provisions available from function keys. There's no status report of the cursor's row and column position, nor any indication of which part of the report (header, footer, detail, and so forth) a given line falls into.


FACT FILE



**Intelligent Query,
Version 1.20**
Programmed
Intelligence Corp.
6991 Peachtree
Industrial Blvd.
Norcross, GA 30092
(404) 446-8880

List Price: \$500
Requires: 256K RAM, two disk drives or hard disk, DOS 2.0 or later.

In Short: This report writer, aimed primarily at vertical-market software manufacturers, has pop-up windows to prompt you and powerful features to help you write flexible reports with minimal effort. New, upcoming versions for end users of *dBASE*, *dataFlex*, and *COBOL* look most impressive. Not copy protected.

CIRCLE 638 ON READER SERVICE CARD

Nevertheless, the report-painting system can generate reasonably flexible reports with minimal effort.

IQ provides two forms of graphics output, *x-y* graphs and histograms. These simple, blocky graphics use the IBM high-order character set. While not particularly smooth-looking, they are a useful analytical tool and can be run on any terminal.

You can output data in 1-2-3 WKS, *Multiplan* SYLK, DIF, or straight ASCII form. It seems somewhat odd that you can't create a *dBASE* DBF file directly, although you can always create a schema in *dBASE* and import an ASCII data file.

IQ's data dictionary stores file definitions and relationships. Although a utility interfaces both 1-2-3 and *dBASE* files more or less automatically, you must still define file interrelationships. This process is slightly easier than with some similar programs, but it's extra work. You can use *IQ* with a number of other data manipula-

tion programs and data formats, including several types of fixed- and variable-length records, *MDBS*, *Btrieve*, Microsoft, mbp, Ryan-McFarland and Microfocus COBOLs, and a few others.

IQ is smart enough to read both *dBASE* NDX and *Clipper* NTX native index files and to use them for keyed retrievals. This saves time because *IQ* doesn't have to build the files again.

The documentation is barely adequate. Two tutorials show you how to create a query and a report, but the manual is terse and not particularly helpful. There's no index, the one-page glossary is skimpy, and the address and phone number of the vendor are nowhere to be found.

The *IQ* query language is flexible enough, but the goal of a report writer is to enable you to circumvent programming or programming-like tasks. After all, if you're willing to learn 130 keywords, you might as well program your reports in

dBASE. Still, you can obtain most of *IQ*'s benefits through the menu system (summaries and conditionals are the most significant features not available through the menu mode). Of course, if you're a software developer—*IQ*'s primary target—the complexities of the language don't present a problem, since you're likely to program the system for your customers.

Programmed Intelligence tells us it plans to release a series of new end-user-oriented versions this fall—with completely rewritten documentation—aimed at the *dBASE*, *DataFlex*, and COBOL markets. We've seen some of the new features that the developers plan to incorporate, and they look impressive. Pricing has not yet been set but will probably be in the \$150 range for *dBASE*, \$300 for *DataFlex*, and \$500 for COBOL.

The version of *Intelligent Query* that we examined offers a lot of powerful technology, and we expect the upcoming versions

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CIRCLE 313 ON READER SERVICE CARD

PC MAGAZINE ■ DECEMBER 8, 1987


■ REPORT WRITERS

to be formidable competition in the *dBASE* report writer category. You should probably pass on Version 1.20, but you will want to keep an eye out for the new versions that Programmed Intelligence has to offer.

PC/Focus *dBASE* Interface


A new option named *PC/Focus dBASE Interface*, a \$195 program, will be available with *PC/Focus*, Release 3.0, from Information Builders. *PC/Focus* is a massive, complex \$1,295 database management package ported to the PC from mainframes. The obvious target market is users of the mainframe program, who can use their large system applications on personal computers with minimal hassle.

When we say massive, we mean massive. The prerelease Version 3.0 of *PC/Focus* arrived on 18 floppy disks. It's



FACT FILE

PC/Focus *dBASE* Interface
Information Builders Inc.
Micro Products Division
1250 Broadway
New York, NY 10001
(212) 736-4433



List Price: \$195 (*PC/Focus*, Release 3.0, itself is \$1,295).
Requires: 640K RAM, hard disk, DOS 2.1 or later.

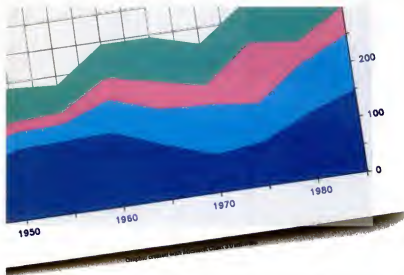
In Short: This option for *PC/Focus*, Release 3.0, is an important enhancement for users of the database program ported from the mainframe environment, eliminating the time and trouble of file definition and conversion when accessing *dBASE* files. Users who do volume work with *dBASE* files will especially appreciate its capabilities. Not copy protected.

CIRCLE 636 ON READER SERVICE CARD

copy protected, but you can simply copy the files to your hard disk and use the activator floppy as a key disk to start the program. The software occupies over 5.5 megabytes, but if you don't need all the modules, you can get by with less.

The *dBASE Interface* option lets you access *dBASE III* and *dBASE III Plus* data and index files directly. You don't need to redefine your *dBASE* files in any way or create Focus Master File Descriptions. All the powerful features of *PC/Focus* are available immediately.

A full review of *PC/Focus* is beyond the scope of this article; we evaluated the program as part of Project Database (*PC Magazine*, Volume 5 Number 12). With regard to report generation, our reviewer noted that "you can produce extensive and complicated reports—however, it is not a simple task . . . Data can be displayed in columnar or across-the-screen format, and all types of calculation, breaks, and total-



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ing can be programmed. But in order to make full use of the options available, you must have a good working knowledge of the Table language."

PC/Focus also includes a module called *Tabletalk*, which uses pop-up windows to guide you through generating reports. It doesn't allow access to all the features of the complex Table language, but it can handle many straightforward reporting tasks. As you choose options from the windowed prompts, the system builds the Table language program to process your choices in another window. This process is educational as well as productive, and you can learn much about Table by exercising *Tabletalk*.

TWO MORE DISKS *dBASE Interface* is supplied on two more floppy disks. Its files overwrite eight of the regular *PC/Focus* files; if you prefer, you can install the *dBASE Interface* files in a subdirectory to

leave your original copy of *PC/Focus* unmodified.

With the *dBASE Interface* in place, *PC/Focus* searches first for standard Focus files when you issue a command to access a data file. If it can't find the Focus file you've specified, it assumes the file must be a *dBASE* file and proceeds accordingly. You can use *PC/Focus*'s *Join* command to access more than one *dBASE* data file (up to 16, in fact), but you must have created the appropriate index files from within *dBASE*. You can *Join dBASE* files only to each other; you can't *Join a dBASE* file to a standard Focus data file. As mentioned, there's no need to create a Master File Description, but you can do so if you want to use *PC/Focus*'s field-editing options.

MULTIFILE REPORTS We verified that the *dBASE Interface* accessed standard *dBASE III Plus* files by working with our Project Database test data files. Table-

talk had no trouble accessing a single *dBASE* data file, and the program produced simple reports with little difficulty. By means of *Join*, we were soon producing multifile reports using *dBASE* files. Using the Focus language, oriented around keywords, you can produce simple reports with little effort and more complex output with somewhat more attention to the advanced features.

The program is on the slow side, even on our test AT equipped with an Intel Inboard 386 operating at 16-MHz clock speed and with a fast Priam 233-megabyte, 20-millisecond-step-rate hard disk. But as we explored the system, we were impressed with its capabilities.

PC/Focus dBASE Interface is a useful and important enhancement for *PC/Focus* devotees. It can eliminate the time and trouble of file definition and conversion when you are accessing *dBASE* files from within the *PC/Focus* environment.

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■ REPORT WRITERS

Quickreport for dBASE

Fox & Geller was one of the first companies to jump on the *dBASE* bandwagon, and their \$295 *Quickreport for dBASE* was the first third-party offering to address the weaknesses of *dBASE*'s report generation facilities. The program has gone through several incarnations over the years, but the soundness of its concepts and design has stood up well.

The *Quickreport* screen is divided into what Fox & Geller calls windows, but they are really screen segments. The top window serves as both the blackboard on which you paint your report and the area in which the menus are displayed. The other windows are an information/status line; a list window that displays drives, file names, field names, and the like; and a message area.

The detailed, easy-to-read program menus drop down from a list along the top of the screen, somewhat as in *Framework*. You choose the menu you want with the Left or Right Arrow key, by typing the first letter of its name, or with the Ctrl key and the first letter—again as in *Framework*. *Quickreport* doesn't support a mouse, but you really don't need one.

ONE AT A TIME The interface has both pros and cons. The menu structure is simple and to the point, and the multiple status

and message areas allow you to obtain reasonably detailed assistance without manually accessing the extensive, well-written help screens. On the other hand, the pop-up window approach used by several competitive products shows you all the various options available at any time, while you may have to lap through options one at a time with *Quickreport*.

Quickreport uses the familiar report division scheme of header, body, and footer. You can specify a report header and footer that precede and follow the report itself (for a covering letter or memo, for instance), headers and footers for each page, and headers and footers for each group you specify. The program's capable editing facilities are easy to learn and use.

You can insert special graphics characters into your report, but only by typing in the three-digit ASCII code with the Alt key depressed. There's no listing of the codes; you're referred to the BASIC manual instead. On a brighter note, *Quickreport* has a useful line-drawing mode that lets you dress up your report with lines and boxes. The program automatically draws the appropriate characters for corners and line intersections.

PRINTER CONTROL You can also apply printer attributes like boldface, underline, italics, double width, and condensed to any text or fields. The program knows the printer control codes for only a half-dozen or so printers, but you can supply the codes for your printer if necessary.

Quickreport provides several unusual field-formatting options. You can specify a variety of methods of displaying negative numbers and zeros, float characters before a number (useful for check writing), choose from several date formats, and more. A reasonably extensive list of string, date, and mathematical functions lets you define calculated fields with some sophistication.

Quickreport allows up to 16 sort and break fields—an extraordinarily generous quota and more than would ever be required in any normal report.

RELATIONAL REPORTING *Quickreport* is a relational report writer. You can define up to five files to be linked to your master data file during report generation.

The linked files must be indexed on the key field used for the lookup. You must generate the indexes using *dBASE*, since *Quickreport* itself doesn't include any indexing provisions.

The linkage process is unambiguous. *Quickreport* guides you through the procedure of selecting the files and the linkage fields. Once you've created your links, all the field names in the linked files are available for use in your report. *Quickreport* handles one-to-one and one-to-many linkages automatically, assuming that you want the multiple records looked up in a one-to-many linkage as individual lines in your report. You can also "chain-link" a series of files on different fields. This linkage system is light years ahead of *dBASE*'s file relation facilities.

Once you've defined your report, you can execute it directly within *Quickreport* or within *dBASE* through the RUN command. Fox & Geller also supplies a runtime version, which can execute reports but not define new ones. Developers can supply their customers with the runtime module at no cost, which should encourage the use of *Quickreport* as an alternative to time-consuming manual *dBASE* programming.

FULL COMPATIBILITY The version of the program that we reviewed recognizes *Clipper* NTX index files as well as the standard *dBASE* NDX indexes. By the time this article appears, a new release that can also deal with *FoxBASE Plus* IDX indexes should be available, at no additional charge to previous users. *Quickreport* will then be compatible with both *dBASE* and all the *dBASE* clones available.

We had no trouble generating a variety of attractive reports from our test files. *Quickreport* was noticeably faster than several of the competing products, perhaps because much of it is written in assembly language.

Quickreport for dBASE is a fine product with many excellent features. At \$295, the program's price is a bit high, but you can find it for much less. We'd like to see the user interface modernized in some respects, but even as it now stands, *Quickreport for dBASE* is a likable program that demands and deserves serious consideration.



FACT FILE



Quickreport for dBASE,
Version 1.6
Fox & Geller
604 Market St.
Elmwood Park, NJ
07407
(201) 794-8883
List Price: \$295

Requires: 384K RAM, two disk drives or hard disk, DOS 2.0 or later.

In Short: The first third-party report writer for *dBASE* users, this likable program uses a *Framework*-style interface and, although it could use a few interface improvements, has a lot to offer. Its new release will make the program compatible with not only *dBASE* but all its clones, too. Not copy protected.

CIRCLE 634 ON READER SERVICE CARD

RAMIS PC/Workstation

RAMIS PC/Reporter is part of **RAMIS PC/Workstation**, a \$375 package from On-Line Software International. Like **PC/Focus**, **PC/Workstation** is a mainframe database management system that has had portions of it ported down to the PC environment. Much of its appeal lies in its ability to up- and download data from the mainframe and manipulate it off-line on your PC.

RAMIS PC/Workstation consists of **Workstation Manager**, a DOS shell; **RAM-Link**, a telecommunications module; **KeepIT**, a complete database manager; and **PC/Reporter**, the report writer.

Workstation Manager's window-oriented user interface is highly intuitive and requires little or no training to use. It makes excellent use of color, and you can select your choices with a mouse as well as with the keyboard. You can add applications and build submenus to accommodate your favorite applications. **Workstation Manager** includes encryption and decryption facilities, which you can apply to your files to hide them from inquiring eyes. While **Workstation Manager** is not as sophisticated as many third-party DOS shells, it is functional and attractive.

RAMLink is a telecommunications utility

for accessing **RAMIS** services on a mainframe. Like the other **RAMIS** programs in the group, **RAMLink** offers a choice of menu-driven and direct command entry methods. It includes its own

language to automate communications tasks like logging on and off the large system or uploading and downloading data to the **RAMIS** database manager, report writer, and other facilities.



FACT FILE



RAMIS PC Workstation, Version 1.0
On-Line Software International Inc.
2 Executive Dr.
Fort Lee, NJ 07024
(800) 642-0177

List Price: \$375, including **PC/Reporter**, **RAMLink**, **KeepIT**, and **Workstation Manager**.

Requires: 512K RAM (640K RAM recommended), hard disk, PC-DOS 2.0 or later or MS-DOS 2.11 or later.

In Short: An easy-to-use bargain of a combination program ported from the mainframe environment—with DOS shell, telecommunications, full database management, and menu-driven report writing. The language syntax is rich, and many interesting commands are available. Not copy protected.

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■ REPORT WRITERS

On-Line Software International purchased *KeepIT*, the general-purpose database manager, from Martin Marietta. We reviewed *KeepIT* in Project Database (*PC Magazine*, Volume 5 Number 12) and criticized it primarily for its clumsy user interface. On-Line Software International has successfully reworked the interface to bring it in line with the other members of the *PC Workstation* family. The window interface is appealing and easy to use.

KeepIT is a full-featured database manager with provisions for screen design and the ability to work with multiple files. The vendor has grafted almost all of the menu and command-syntax reporting facilities available with *PC/Reporter* onto *KeepIT*. You can access data files in 1-2-3, *dBASE III*, DIF, and fixed- and variable-length ASCII formats. *KeepIT* is an impressive package that could stand on its own; as a component of the *PC/Workstation* package, it's an excellent value.

REPORT WRITING The *PC/Reporter* report writer can retrieve data from *dBASE III* files directly, with no further ado. If you want to access data stored in DIF or fixed- or variable-length ASCII files, you must define a field description file and, with DIF files, a format description file. You can create a synonym file for any data file that defines alternate names for the data fields.

PC/Reporter's painless access to *dBASE* files brings with it a few negatives. *PC/Reporter* has no date field type, so it converts *dBASE* dates to eight-position alphanumeric fields. Similarly, *PC/Reporter* converts *dBASE* logical fields to single characters. Also, it ignores memo fields. None of these problems is severe, but the next release of the program should solve them.


The menu-driven approach to report definition is quite similar to that used by the program's more advanced competi-

tors. Multiple-choice windows pop up as your input is required. Text entry windows sometimes solicit text input, and detailed context-sensitive help windows are always available. Function keys provide other options, with the meaning of each key always displayed at the bottom of the screen. This interface is both inviting and functional.

As with similar programs, the menu system builds the actual program commands in a display window as you make your choices. This instructive aid helps you learn the language syntax quickly. There's no difference between programs created by the menu system or directly by you with the syntax method, although you can't access all the system's features through the menus.

INTERESTING COMMANDS The language syntax is quite rich, and it allows you to define attractive and complex reports. The language is very close to that

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*Chart is compatible with most major business software file formats including ASCII.

†The Chart 3.0 trial version uses a limited number of fonts and cannot save or print. Output produced using Microsoft Chart 3.0 with a Matrix PCR® 35mm Film Recorder and a Hewlett Packard 7550A plotter. Other good in the 50 United States only.



■ REPORT WRITERS

used in *Focus*. Some of the more interesting commands let you place text notes before or after break groups; add notes before or after the report itself; define formatting masks; use a nifty Decode command that converts code values in your data to more descriptive terms; and access flexible statistical functions, including such unusual calculations as population standard deviations and variances, weighted averages, footnotes, and so forth. Certain commands let you position columns and other report elements precisely, but these aren't as easy to use as in programs where you simply paint the screen layout.

We were able to access our *dBASE* test files with no difficulty. *PC/Reporter* handled them just as it did files stored in its own data format. The easy-to-use menu system is effective. As we observed the language that was generated, we began to use the syntax system more, entering our report definitions manually. You can edit

definitions immediately after the reports are generated, which encourages modification and experimentation.

ONE AT A TIME Our only major objection to *PC/Reporter* is that it does not have relational capabilities. *KeepIT* does, but it doesn't offer *PC/Reporter*'s transparent access to *dBASE* files. We imagine the idea is to perform whatever relating you need on mainframe *RAMIS* or with *KeepIT*, but we still think there's something amiss here. If the developer added the *dBASE* interfacing to *KeepIT*, there would be little reason for *PC/Reporter* to exist by itself, especially since both programs are bundled together.

PC Workstation is a bargain for only \$375. If you're in a mainframe *RAMIS* environment, the package is still more attractive. And Release 2.0, which was not available in time for this review, will add even more capabilities to this impressive

product. We don't think we'd choose it strictly as a *dBASE* report generator, though, since fully relational report writers are available for less money.

R&R Relational Report Writer

Concentric Data Systems' *R&R Relational Report Writer*, at \$149, has zoomed to a leadership position in the *dBASE* report writer category since its introduction last year. *R&R*'s sudden rise to fame is understandable: it's a terrific piece of software.

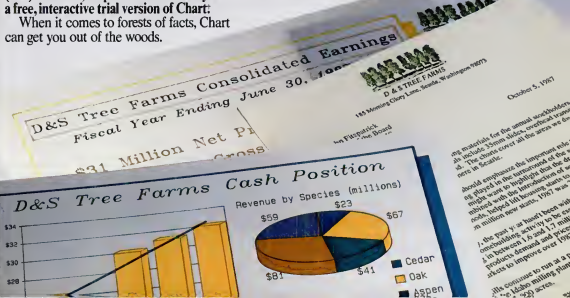
R&R uses 1-2-3-style horizontal menus. The kinship to the Lotus interface extends to the use of the Slash key to invoke commands, the traveling light-bar cursor, and the one-line menu explanations beneath the options themselves. 1-2-3 users will feel comfortable immediately, but those who don't use 1-2-3 will like *R&R* too.

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COUPON!!!

CIRCLE 363 ON READER SERVICE CARD

REPORT WRITERS

**EDITOR'S
CHOICE**

R&R Relational Report Writer, Version 2.0
Concentric Data Systems Inc.
18 Lyman St.
Westboro, MA 01581
(800) 325-9035
(617) 366-1122 (in Mass.)

List Price: \$149; **Clipper and FoxBASE Plus module,** \$49.95.

Requires: 320K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.

In Short: This impressive, inexpensive **dBASE** report writer uses 1-2-3-type menus and delivers ease of use and flexibility. It's a real winner, deserving of its leadership position in the market. Not copy protected.

CIRCLE 633 ON READER SERVICE CARD

R&R employs the common header/detail/footer scheme of report organization. Unlike the way many programs work, only one detail line appears on the blackboard when you paint your report; you must add lines in the other sections as you need them. The editing commands are unusually flexible and extremely easy to use. The full IBM character set is available. You can enter any single character by selecting it from a screen of the full set—much easier than typing Alt sequences. You can apply any printer attribute to elements of your report.

MORE THAN ONE FILE Relating files is extremely simple. You only need choose fields from pop-up windows and indicate whether you want a one-to-one or one-to-many relationship. You can use up to ten databases in one report, with multiple relations from each file. Relations can be nested, and you can even relate a file to itself. You also specify what to do if there's no matching record: print the record anyway, skip it, or terminate the report. **R&R** builds an English description of the relation on your display, which makes it even easier to be sure that the relation is going to do what you intend.

R&R creates what it calls a composite record from all the called data files. It refers to normal one-to-one relations as look-ups and one-to-many relations as scans.

The terminology is somewhat offbeat but descriptive. The flexibility is almost mind-boggling.

DEFINING THE REPORT The process of actually defining the various headers, footers, detail lines, group and report summaries, and other report elements is simple. The pop-up windows always show the available fields, including fields in related files, using normal **dBASE** syntax.

Defining calculated fields is equally straightforward, with all the standard arithmetic, date, relational, and logical operators, as well as enhancements like a percentage operator. **R&R** offers automatic character field trim and many other useful features. An extensive list of 74 functions for string, numeric, and date manipulations is available, many of which are very useful and lacking in **dBASE** itself. Once you define a calculated field, it appears in the composite record too.

R&R also generates English for the selection criteria (Query) you might define to narrow down the records to be included in your report. In addition to the normal relational operators, **R&R** adds range and list commands to facilitate building powerful queries easily.

The program treats memo fields like character fields in most respects, making memo fields much more useful than usual. You can take advantage of the word-wrap feature on normal character fields as well as memo fields.

R&R provides up to eight levels of grouping and sorting—more than enough for any report. It uses **dBASE** index files to save you the trouble of redefining index keys or internal **R&R** sorts in many circumstances. If you buy the optional \$49.95 **Clipper/FoxBASE** module, you can use the **NTX** or **IDX** index files created by those programs instead of **dBASE** **NDX** files if you wish. (WordTech's **Quicksilver** compiler and **dbXL** interpreter use standard **dBASE**-type index files, so you don't need the special module with these programs.)

LAYOUT AND PRINTER CONTROL

Elaborate and informative specifications on report definitions, file linkages, database status, and more are easy to obtain. **R&R** lets you control both report layout

and printing specifications readily.

R&R employs memo fields in a nifty form-letter system. You create a data file with a single memo field, into which you insert the letter text with field names surrounded by backslashes. You then relate your data file containing the addresses of recipients to the memo data file, and *R&R* prints personalized form letters much the way that a sophisticated word processor does.

As for printing, you have complete control over margins, pitch, font, and page orientation on laser printers, as well as mailing-label layout, output destination, and more.

dBASE, *Clipper*, and *FoxBASE* developers can define reports with *R&R* and then call *R&R* from within their programs, thus saving the time and effort needed to program the reports with the *dBASE* language. A no-cost run-time version of *R&R* is included on the distribution disk.

R&R's documentation is unusually good, with text that's clear and to the point. Four thorough tutorial lessons teach the majority of the program's functions; unlike many tutorials, these explain not just what to do, but why you do it.

ON THE FLY We had little trouble generating our test reports. The *R&R* interface is so straightforward, and the correspondence to *dBASE* methods and syntax so high, that we were able to specify exactly what we wanted with few retries, even with reports that accessed multiple data files. It's a pleasure to be able to define file linkages on the fly, during report definition, rather than having to decide in advance how to organize access to the various data files.

Execution speed was a trifle on the slow side, especially if we specified several levels of sorting, but the tremendous amount of time saved (compared with what might have been spent in programming) compensated for any minor slowdowns.

R&R Relational Report Writer is impressive. Many programs claim to combine ease of use and flexibility, but *R&R* is one of the few that actually deliver. Its price, hundreds of dollars lower than the cost of some competitive programs offering less, is another big plus. *R&R Relational Report Writer* is a winner.

Reports Plus

Reports Plus, from Softsync for \$149.95, is a flexible report writer that is both easy to use and powerful. It lets you access data

from a variety of data sources with a minimum of effort.

Reports Plus works directly with dBASE II or III, 1-2-3, SYLK, DIF, and ASCII data files. Helpful suggestions on

[illegible]

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■ REPORT WRITERS

working with applications like *Ability*, *DataFlex*, *Framework*, *Javelin*, *Q&A*, *R-base 5000*, *Reflex*, and other programs are provided too.


Informing *Reports Plus* about a *dBASE* DBF file, for example, is as simple as identifying the file to the program. *Reports Plus* will then read the *dBASE* file, determine the file structure, and display it. You can provide long English names for the fields if you wish; this doesn't change the field names in the file itself, but it makes things more pleasant while you're working in the *Reports Plus* environment. You can also change character fields to dates if you like, which is essential for coping with *dBASE II*'s lack of a date type.

There are a few limitations to this direct file reading. *Reports Plus* can't read *dBASE* memo fields. 1-2-3 data files must include a range named Report, the sheet must be rectangular, the field names have to be in the first row, cell formats in a col-



FACT FILE

Reports Plus
Version 2.0



Reports Plus
Version 2.0
Softsync Inc.
162 Madison Ave.
New York, NY 10016
(212) 685-2080
List Price: \$149.95
Requires: 256K RAM,
two disk drives, DOS 2.1 or later.

In Short: This flexible report writer is powerful, easy to use, and a good buy. You can access data from a variety of data sources, including 1-2-3 spreadsheets, with minimal effort. Not copy protected.

CIRCLE 61 ON READER SERVICE CARD

umn must be uniform, and so forth. Similar restrictions exist for the other data formats, but none of these problems is severe.

SUPERB INTERFACE *Reports Plus* uses a menu interface that is especially well organized and functional. The bottom part of the screen is divided into four boxes containing data file names and the names you've assigned to queries, report definitions, and "tasks" you've defined. A task is a combination of a query and a report, so you use the query as a selection to filter the records output in the report.

The top part of the screen displays various commands available, such as Import Files, Define New Queries, and the like. You can use either the arrow keys or a Microsoft Mouse to select your choices. This is one of the best-arranged menu-driven interfaces we've seen.

Defining queries is as easy as pointing. *Reports Plus* displays the fields in your file and the available relational operators at the appropriate time, and you just pick what you want. The program has a clever visual method of displaying AND and OR rela-

Maybe it's not what you're saying that's so dull.

Printed Author
Page 1 of 1

FIRST HALF RESULTS

There has been much of the year's activity in the first half of the year. The first half of the year has been a very busy time for the company. The first half of the year has been a very busy time for the company. The first half of the year has been a very busy time for the company.

NEW PRODUCT

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SHORT PROGRESS & NOTES

There has been a lot of activity in the first half of the year. The first half of the year has been a very busy time for the company. The first half of the year has been a very busy time for the company. The first half of the year has been a very busy time for the company.

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tionships. If you add criteria in one box on the screen, each pair is related with an OR. You can also add new boxes, each with one or more criteria. New boxes are connected to other boxes with lines, which signify an AND relationship.

IN ADDITION TO *Reports Plus* gives you useful relationships such as "begins with," "contains," and "in range from" to shorten complicated selection definitions, and simple arithmetic is available too. The program also provides a third type of relational operator, which is rather like "in addition to." *Reports Plus* eliminates any duplications that would result from records being selected by multiple conditions. You can edit, move, copy, or delete portions of the definitions.

All this capability is harder to describe than to use. You can define complex selection criteria in no time—without anything that even approaches programming.

Linking files together is equally direct. It's no more difficult to link, say, a *dBASE* and a *1-2-3* file than two *dBASE* files, as long as you've obeyed the file layout restrictions. When you link files, the program saves your specification, but it doesn't physically link or combine the data until you run a query or report and specify disk output. *Reports Plus* lets you establish up to ten one-to-one relationships, but it can link only two files in a one-to-many relationship. You can process a one-to-many relationship to disk, which creates the actual disk data file, and then define another relationship to that file. This procedure is slightly cumbersome compared with defining complex linkages directly, but it works smoothly enough.

PAINTING REPORTS You paint reports by positioning the cursor where you want things and using the menu system. The report page is divided into sections,

such as page header and footer, detail lines, and report footer. If you create sub-totaling groups, you also get group headers and footers. A handy option lets you create a front page of organized text. You can sort data on up to five fields, and each can be either ascending or descending.

Two manuals guide you in using the program. One is called "Quick Start and Examples," although it's 143 pages long. The other is the technical reference manual, which itself runs more than 160 pages. The reference manual is a little out of date; the program can do some things the manual says it can't, and the program isn't copy protected as stated. Apart from these minor glitches, both manuals are beautifully written and extremely helpful.

We experienced no difficulties in accessing our test files or generating attractive reports. The program's menu interface is simply delightful to use with either keyboard or mouse.

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REPORT WRITERS

Reports Plus is a first-class report writer. Clearly, it's aimed at a somewhat less technical user than the excellent *R&R*, and it does somewhat less. But we found its compromises between ease of use and

flexibility to be well chosen. And, of course, the ability to mix data from 1-2-3 spreadsheets and other sources is a real plus. *Reports Plus* is a good value at \$149.95; you'll want to give it a try.

Snow Report Writer

Snow Software's \$695 *Snow Report Writer* is a high-priced but powerful report writer. It is noteworthy for its ability to access data from a variety of sources.

The list of data formats that *Snow Report Writer* supports includes over 55 applications and languages. Among them are *dBASE II and III*; *R:base 5000*; various BASIC, C, and Pascal interpreters and compilers; several COBOLs; fixed- and variable-length ASCII, *Informix*, *DataFlex*, *Btrieve*, and binary files; and many more. The program can also write to 1-2-3 WKS, *Multiplan* (SYLK), *VisiCalc* (DIF), *PerfectCalc*, C-BASIC, and ASCII file formats.

Snow Report Writer distinguishes between queries and reports. The only difference is the destination of the output: the screen for a query, hard copy or a disk file for a report. You can define templates for repeated use with updated data.

You can also do Quick Queries, with a simplified method of formatting and performing a report in one step. The program doesn't save these ad hoc Quick Queries for future use. You can send output to the screen, a printer, or a file. You can combine various selection criteria, simple four-function arithmetic, and data from multiple files into the results. Three sort fields are available too.

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PC FACT FILE

Snow Report Writer, Version 3.0
Snow Software
2360 Congress Ave.
Clearwater, FL 34621
(813) 784-8899
List Price: \$695; Network Version, \$995;

Run-time Version, \$50; U.S.E.R. Report Writer, \$295.

Requires: 384K RAM, two disk drives, DOS 2.0 or later.

In Short: This menu-driven program is a high-priced but powerful report writer with a noteworthy ability to access data from a wide variety of sources. It's really more appropriate for developers and programmers than for novices. Not copy protected.

CIRCLE 630 ON READER SERVICE CARD

CIRCLE 277 ON READER SERVICE CARD

Snow Report Writer presents your options in simple vertical menus. You move a light-bar cursor to the option of your choice. A status line at the bottom of the screen indicates which function key options are available at any time. You select many of your options from pop-up windows that appear as your input is needed. The windows overlap one another to indicate visually the hierarchy of the commands. This system is attractive and works well.

FULL QUERIES/REPORTS You can specify a full query or report in two ways, either by painting it or by using a menu structure. The paint method employs two: screens, one a fill-in-the-blanks form for titles, headers, up to seven sort fields, and the like, and the other for the details of what to include and where to place it in the output. The screen lines are divided into header, detail, subtotal, and footer categories. You can change the number of each if necessary. Once you've laid out the report, you must translate the layout into "query/report specifications," a step you'd think shouldn't be necessary. You can then execute the query/report, specifying selection criteria and other details.

Once defined, query/reports can be edited. You can control the exact line and column positions for fields, numeric formatting, and other specific design elements. For example, *Snow Report Writer* lets you add extensions to field names to perform such functions as running balances, percentages, deviations, totals, averages, counts, and maximum and minimum values. Another nifty feature is a conditional test to determine whether to include a given field within a record.

LOOKUP POWER *Snow Report Writer* provides exceptionally powerful yet complex lookup capabilities. You can relate files with five linkage methods: keyed read, to look up by value, assuming the matching field in the lookup file is unique; one-to-many keyed read, where the looked-up file may contain many records matching the lookup record in the main file; one-to-many keyed read chain, which uses two consecutive fields to look up the desired information; direct read, which uses the record number rather than a key to

locate the matching record in the looked-up file; and one-to-many direct read chain, which also uses record numbers but chains to a next record—specified by a record number field in the looked-up file.

If this sounds complex, it is. All these lookups use a rather odd postfix sort of notation as well as nonstandard symbology to indicate the various types of file relationships.



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- ☐ **WORD 1a,b**—(2 disks) PC Write 2.71, a powerful word processing system wispell checker, letter setup.

Most software listed is shareware or user-supported.

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REPORT WRITERS

Several other utilitarian options are also included. For example, you can "compress" fields, removing trailing blanks (as dBASE's Trim function does); center fields; print a bar graph instead of a numeric value; change printer fonts; and more.

DICTIONARY BASIS The system is based on a data dictionary structure called the Catalog of Information. The data dictionary is a list of all the files and fields you have defined for *Snow Report Writer*. Incidentally, software developers can use several files that show up in a listing of the contents of the data dictionary (and in specification lists and elsewhere); these potentially confusing files should perhaps be hidden.

If you use *dBASE II or III*, or *Ryan-McFarland* or *Micro Focus COBOL*, you can load the data dictionary automatically. You can (and should) add a prefix to each field name, since all files and fields in the data dictionary must be unique.

The manual leaves a detailed discussion of the data dictionary system until nearly the end, though you can do nothing without defining files and fields. The likely reason is that the data dictionary system will be confusing to most users. The system has 15 file types, and you'll have to understand such matters as field separators, ASCII codes, delete flags, and whether your data files insert a byte that specifies the length of a field, unless you're using the autolink system. Similarly, *Snow Report Writer* recognizes 20 types of fields and 27 field formats. The flexibility you gain is impressive, but you'd better know what you're doing.

You can redefine all the context-sensitive help text—useful for customized applications. Making changes is easy; you hit a key and enter the text you want.

WEAKNESSES One weakness of a non-dBASE-specific report writer is that it doesn't take advantage of dBASE features. For example, *Snow Report Writer* doesn't use dBASE's DATE data type. It includes functions to convert dates into Julian date numbers or vice versa for math, but this method isn't as clean as dealing with dBASE date math directly.

More important, *Snow Report Writer* doesn't make any use of the index files cre-

ated by dBASE. The program performs all indexing internally. It thus avoids the issue of index file compatibility among dBASE, FoxBASE, and Clipper, but the process of indicating key fields is clumsy.

The menu system can impose rather inconvenient keystroke demands. For example, to add two values and take 10 percent of the total entails 15 selections (since each parenthesis and operation is a separate selection). You can enter inputs manually once you understand the syntax—a much faster method.

Snow Software also offers a network version with record and file locking for \$995. It works on Novell, PC Net, Token-Ring, and 3Com networks. A run-time version that can execute predefined reports is available for \$50 a copy (several other report writers offer run-time versions at no additional cost).

Snow Software also provided us with a copy of their *U.S.E.R. Report Writer*, which sells for \$295. They position this variant as "more application-oriented"; it supports 1-2-3, dBASE, BASIC, and other "common" file formats, and is essentially a subset of the full *Snow Report Writer*—at a somewhat more reasonable price. The program is structured somewhat differently but retains the fine menu and pop-up window interface and most of *Snow Report Writer*'s features.

MIXED RESULTS We found the context-sensitive help to be rather unhelpful. The messages are often short and don't really explain the meaning of the options available at any time or how they're used. When we made a mistake, the error message was a generic "Errors detected—please correct." Hitting the Tab key in several cases caused an error message of "F9 not allowed."

The automatic dBASE import worked fine, but we had trouble figuring out how to relate files. The extra steps required to define all possible linkages among files are cumbersome and tedious, and only a sophisticated user will understand and be able to use the various lookup methods.

Our reactions to *Snow Report Writer* were mixed. The pop-up window interface is well designed and helpful, and the ability to access information stored in almost any data format could be sensational for

PC EDITOR'S
CHOICE

• **R&R Relational Report Writer**

Concentric Data Systems' R&R Relational Report Writer stands out from the crowd—a stunning combination of a comfortable and informative user interface, supremely easy access to multiple related files, and extensive report design and enhancement tools. Usable by novice and expert alike, it is superb for generating either straightforward or complex report output—at a reasonable price. The only thing we'd like to see in the future is the access to 1-2-3 and other non-dBASE formats offered by some of the competitors.

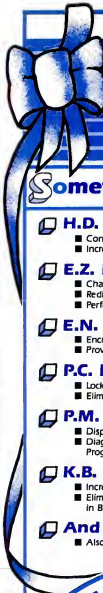
Several other programs deserve mention. Reports Plus shows that clever design can make a straight menu-driven interface attractive and flexible. Quickreport for dBASE and Snow Report Writer include many appealing features, and PC/Focus dBASE Interface and RAMIS PC/Workstation's PC/Reporter are fine choices for those who use their mainframe counterparts. Intelligent Query holds promise for the future.

All the programs we tested beat the dBASE III Plus internal report writer hands down. Until (and if) Ashton-Tate upgrades its reporting capabilities, these programs can save you both time and money.

those who need it. However, the data dictionary system requires a lot of knowledge and work if you aren't using dBASE files. Even if you are using dBASE, the definition of file relationships is complex—far beyond the skills of the novice.

Snow Report Writer is more appropriate for developers and programmers, who will be able to master its intricacies and to absorb its hefty price of \$695. [E]








Glenn A. Hart is a contributing editor of PC Magazine.



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■ PC LAB NOTES: PROGRAM LIBRARIES ■ MARK NOVISOFF

CREATING AND USING PROGRAM LIBRARIES

If the new language offerings from Microsoft and Borland have stimulated your interest in serious user programming, the next step is to use libraries to keep from reprogramming.

With the introduction of such easy-to-use languages as Microsoft's Quick and Borland's Turbo series, increasing numbers of PC users are discovering the satisfaction and benefits of doing their own programming. But what many of these programmers haven't discovered is that it's not necessary to "reinvent the wheel" each time they start a new program. Programs usually have many functions in common. These include reading and writing files, deciphering parameters entered on the command line (called "parsing"), input routines, and error messages. Once you've written program code that performs a particular chore, it's both boring and time-consuming to rewrite similar code to perform the same function in another program. Best of all, it's unnecessary.

LIBRARIES Professional programmers long ago came up with the idea of the library, a collection of standard, documented, and debugged routines that can be used like building blocks to create programs. The amount of development time they can save is phenomenal. In this PC Lab Notes, I'll discuss how you can design, create, and use libraries with your programs. The examples presented are specific to Microsoft's QuickBASIC compiler (Versions 2 and 3), but the principles will be generally applicable to any compiler that supports libraries or include files. Depending on the compiler you use, you may need a copy of the librarian program, LIB.EXE. LIB is not distributed on the DOS diskettes but comes with several compiler packages. If

you're working with QuickBASIC 2 or 3, you'll also need BUILD.LIB.EXE.

You may be surprised to find that you're already using libraries extensively. The operating system, PC-DOS, and your

computer's BIOS (Basic Input/Output System) can both be thought of as libraries in the sense that they provide services to your applications programs.

Some high-level languages, like Turbo Pascal, automatically include standard libraries in compiled programs. This code provides your program with the functions most commonly used by Turbo Pascal programs. Other compilers, like QuickBASIC, give you the choice between a "standalone" or "runtime" library.

By creating your own libraries to supplement those included with your language, you'll make your programming chores easier and less time-consuming. You'll also use less disk space because both your source code files and (if you use a well-structured library) your executable programs will be smaller.

INCLUDE FILES Unfortunately, not all current language implementations support true libraries. If you use Turbo Pascal or Turbo Basic, you must use "include files" instead. An include file is a file that contains the source code for the desired routines. It is merged into your program at compile time, and it functions the same as if the instructions were all in a single file. This allows program files to be broken into several modules for easier handling. The drawback to this method is that the source code you include must be recompiled each time your main program is compiled. Nonetheless, since you can include the file in any number of programs, you do get the benefit of standardization.

Moreover, there's sometimes good rea-

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PC LAB NOTES

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Tips for QuickBASIC librarians; Turbo Pascal in the quadrillions.

PC TUTOR

Defective 8088s that can give you hang-ups; DOS's way with the LPTs.

CONNECTIVITY CLINIC

Letting a network server do long compile jobs instead of your PC.

■ PC LAB NOTES

son for using \$Include to access your library routines even in QuickBASIC and Quick C. If you want to see the source code within a subroutine while debugging, for example, the Include procedure is the only way to do it. If you compile your routine and add it either to a "runtime" or a "link" library, you can't view your source code during debugging.

RUNTIME LIBRARIES Runtime libraries are a type of memory-resident program. They are separate files that are loaded into memory when you execute your program. A runtime library is not linked into your programs. Once loaded, the library is accessed through an interrupt or FAR call. The successful use of runtime libraries depends on knowing their exact location in memory and the absolute position of the routines within the library. A common example of a runtime library is the "BRUN" type library supplied with BASIC compilers. Don't confuse this usage of "runtime" with libraries that are available for C compilers. Although these last are called "runtime" libraries, they are really link libraries.

When dealing with applications programs, there are three main disadvantages to the runtime library. First, since the entire library is loaded into the computer's memory, it reduces the workspace that is available to your program. Second, if you sell or give away your program, you must include yet another file on the disk, and that file must be present when your applications program is executed. Third, and worst, some software developers charge a fee for each copy of the library that you distribute.

On the other hand, when developing and debugging a program, a runtime library has distinct advantages over a link library, especially when working with QuickBASIC and Quick C. For one thing, you don't have to exit from the compiler's integrated environment in order to perform a LINK operation. Second, all of the routines in the library are already compiled and available to your program. This saves a lot of time since it isn't necessary to recompile the source code each time you recompile the main program. And third, adding more library services to your program is relatively painless. By contrast,

when you are using a link library, you must reLINK your program after a call has been added.

LINK LIBRARIES Like a runtime library, a link library is far superior to "include files" because the source code has already been compiled. When you recompile your main program, the library routines are not included in the compile process. Instead, the LINK program matches calls in your main program with routines in your library to produce an executable program. For programs that you distribute, this type of library is better than a runtime library since the LINK program includes only the routines that are necessary for your particular program.

Link libraries can contain routines created by any assembler or compiler that produces object modules that conform to Microsoft's specifications. This allows you to merge routines written in more than one

■ Before you rush out and create your own libraries, you need to do some planning and keep certain principles in mind.

language into a single executable program. Known as interlanguage calling, this feature is most commonly used when interfacing routines written in assembly language with a program written in a high-level language. The specific techniques for integrating multiple languages are beyond the scope of this issue's Lab Notes but are discussed in most reference manuals included with your language packages.

LIBRARY STRATEGIES Creating a library is advantageous only when it saves you time and effort in the long run. Before you put a routine in a library, I suggest using the following rule of thumb: if you have a piece of code that provides a service that is used in three or more of your programs, you should consider keeping the

routine in a library. I suggest that you set a minimum of three because if you use a library routine in only two programs, it's probably not worth the extra effort needed to maintain the library.

There is an important exception to my three-program guideline. Any routine that is hardware dependent or that you believe may need to be modified from time to time is a library candidate. Consider a routine that determines the type of monitor in use. If you had written such a routine in 1983, you would only have needed to know about color and monochrome monitors. Today, however, you also need to determine the presence of an EGA, VGA, or Hercules adapter. And who knows what the selection will be next year?

ORGANIZING LINK LIBRARIES Before you rush out and create your own libraries, you need to do some planning and keep certain principles in mind. Spreading your routines among a number of different libraries means spending less time maintaining each library. With that in mind, most link libraries are organized along the lines of common functions, common data, or a combination of the two.

Link libraries are the easiest to organize because the LINK program can handle a number of libraries simultaneously, using (for example) a command line such as

```
LINK MyProg,,VidLibDatLibFileLib;
```

That's why it is common to have libraries organized according to the functions they provide. You might want to consider separate libraries for video routines, data handling, file and device I/O, string handling, and so forth.

When working on a vertical market application, on the other hand, you may find it more sensible to organize your libraries according to the data that they share. For instance, if you have a point-of-sale system made up of a series of programs that handle a number of data files, you might want to include the data-handling routines in the same library with your file I/O routines.

Other situations might lead to a combination of the two types. The point is that your libraries should be organized in a fashion that is logical to you (or the person who takes your place next year) and that

reduces both LINK and maintenance time.

Don't carry things too far—it's very easy to find yourself with video routines in one library that frequently access data areas in another. If that happens, consider moving the video routines to the data-hand-

ling library since the LINK program will have to access only a single library.

GRANULARITY When the LINK program is creating an executable file, it examines each of the CALL statements in

your program and retrieves matching routines from the library as needed. But LINK cannot separate routines that are contained in a single object module within the library. The relationship between a library, the object modules it comprises, and the

USING LIBRARIES INSIDE AND OUTSIDE THE QUICKBASIC ENVIRONMENT

In QuickBASIC 2 and 3, each library routine you work with is called a "subprogram." Subprograms differ from BASIC "subroutines" in a number of ways:

- They are invoked with a CALL statement instead of a GOSUB.
- You don't have a RETURN statement at the end of the subprogram.
- Local and global variables can be defined.
- Subprograms can be precompiled and then linked with the main program or built into a user library.
- User-defined functions cannot be used inside a subprogram.

Subprograms are constructed in the following format:

```
SUB ProgName (Optional Parameters) STATIC
```

```
Your code goes here
```

```
END SUB
```

The word "STATIC" here means that the subprogram is nonrecursive, that is, it does not call itself or another subprogram that calls it.

LOCAL AND GLOBAL VARIABLES

Subprogram variables, including arrays, are considered to be "local" variables; the variables used are not available to the main program, only to the subprogram. Variables can be "SHARED" between a single subprogram and the main program when both are in a single source file and a "SHARED" statement is in the subprogram itself.

Variables are declared as GLOBAL by using COMMON and SHARED together or by naming them in a parameter list. GLOBAL means that the named variable(s) are available to a main program and all of its subprograms.

One drawback to using "COMMON

SHARED" is that you cannot readily switch between using \$Include files and user libraries during debugging. If you have "COMMON SHARED" in \$Include files and in the main program you will get a "duplicate routine name" error, and care must be taken that the number, type, and order of the variable lists agree exactly.

Using a parameter list to pass variables to a subprogram means you don't have to worry about SHARED or COMMON. But it limits the use of the variable to the main and subprograms that have the variable name in the parameter list. This provides more flexibility when it comes to debugging.

COMBINING WITH MAIN PROGRAMS

Once you have thoroughly debugged your subprogram, you must then compile the subprogram into a relocatable object module. Select the "OBJ" option on the "Run" menu (invoked with Alt-R) within the QB environment, or run QB outside the environment as follows:

```
QB Progname;
```

Each subprogram can be in its own file, or you may group more than one subprogram into a single source code file.

WITH USER LIBRARIES The easiest way for you to combine subprograms with a main program is to join your object modules so as to produce a user library. (See the sidebar "QuickBASIC User Libraries: How to Use BUILD-LIB.") You tell QB to work with your user library by using the /L switch, followed by the name of your library file, as shown here:

```
QB myprog/LUSERLIB.EXE
```

The /L switch is used whether or not you are working inside the environment—in other words, you can add the semicolon on the end of the command line if you prefer. Remember that only one user library can be specified in this fashion. Remember, too, that the user library must be present when you execute your compiled program. Note that I have included the .EXE extension on the above command line. If you do not, QuickBASIC will tell you that it is "Unable to load specified User Library". The only exception to this rule is the default user library name USERLIB.EXE. If you want a library of that name loaded, a simple /L is enough—the name is not needed.

One other caution: you cannot use user libraries with "standalone" programs (programs compiled using the BCOM.LIB selection on the RUN menu). Standalone programs must be linked with a link library or have the subprogram source code included in the main program.

QB WITH LINK LIBRARIES You must use a library manager, such as Microsoft's LIB.EXE, to combine object modules into a link library. Unfortunately, the LIB program is not included with QB 2 and 3.

In this case, you must compile your main program into an object module (using the Alt-R command inside the environment or the command line semicolon outside). Then you must exit QB to LINK your program:

```
LINK Myprog,,,Mylib;
```

Programs compiled in this manner can be "standalone" or they can use the QuickBASIC runtime library along with your user library.—Mark Novisoff

■ PC LAB NOTES

routines in each object module is known as "granularity."

Consider two routines that are both being used in conjunction with pop-up windows. One of these routines saves the screen, and the other restores it. It is unlikely you would use either routine without using the other, so both should be in the same object module along with data that is common to the routines, such as the num-

ber of bytes saved. If each routine and the common data are in three separate object modules, the LINK program has to work harder and takes longer to execute. On the other hand, this object module should *not* include a routine whose function bears no relation to saving and restoring screen images.

An example of lack of consideration for granularity can be demonstrated with a

standalone QuickBASIC 3.0 program. When you compile a program that does nothing more than print "Hello", the executable file size is 27K! If you use the LIB program to display a listing of the routines in BCOM30.LIB and how they relate to their object modules, you'll find extremely poor organization. One particularly heinous example is GOSTOP.OBJ. It contains 136 public symbols, most of which

QUICKBASIC USER LIBRARIES: HOW TO USE BUILDLIB

BUILDLIB.EXE is supplied with QuickBASIC (Versions 2 and 3) to let you create libraries of routines callable from QuickBASIC programs. BUILDLIB is actually a special version of the LINK program, modified to create special-purpose runtime libraries called "user libraries."

Version 2.x of the QB compiler limited you to user libraries not exceeding 64K in size. This limitation was removed in Version 3.0, and you are now limited strictly by available memory.

Unlike the LIB program, BUILDLIB is used only to create user libraries: you cannot modify them or even view their contents once they have been created. While BUILDLIB will generate a "list" file, it is useful as a reference only if you use the undocumented /MAP switch.

The syntax to invoke BUILDLIB from the command line is

```
BUILDLIB [switches] ObjModules,[NewLib],
[RefFile],[Libraries][:]
```

[The above must be entered on a single line.—Ed.] Square brackets indicate optional parameters; switches are undocumented features explained below.

ObjModules is a list of object modules to include in the user library. Unless you are converting a link library to a user library, you must have at least one object module on your command line. Remember that one module may contain more than one routine. You may combine object modules produced by any language that supports Microsoft's format, including assembly language routines.

```
BUILDLIB NewObj+GoodObj+SomeObj,USERLIB;
```

Here, NewLib is the name of the

.EXE library file to create. The default is USERLIB.EXE. If you do not enter an extension, .EXE will be added to the library name.

RefFile (undocumented) is the list file. The default is "NUL" (i.e., no file is created). If you enter a name without an extension, it will acquire an extension of .MAP.

"Libraries" is the name of one or more linking libraries that can be brought into a user library. To use this feature, you must invoke the /LIB switch.

The semicolon tells BUILDLIB not to prompt for input, but to process the commands or abort to DOS if unable to do so.

UNDOCUMENTED SWITCHES

When you enter BUILDLIB/HELP from the DOS prompt, the program will respond with

Valid switches are:

```
HELP
INFORMATION
LIBCONVERT
MAP
NODEFAULTLIBRARYSEARCH
NOIGNORECASE
NOPREDEFINITIONS (QB3 only)
SEGMENTS
```

As with other Microsoft products, only the first three letters of any switch need to be included on the command line, and you may use both upper- and lowercase.

■ **HELP** displays a list of switches, as shown above.

■ **INFORMATION** tells BUILDLIB to be verbose as it performs each step.

■ **LIBCONVERT** is used to include all routines from a link library in a user library.

For example, the command

```
BUILDLIB /LIB NewObj,,,MyLib;
```

All the object modules in MYLIB.LIB will be read and combined with NEWOBJ.OBJ to produce USERLIB.EXE (the default name).

■ **MAP** tells BUILDLIB to add more information to the .MAP reference file, such as a listing of all public symbols in the user library by name (alphabetically) as well as by location in the file. Using the MAP switch and the reference file name provides a .MAP file very similar in appearance to the kind generated by the LINK program.

■ **NODEFAULTLIBRARYSEARCH** instructs the program to ignore library names a compiler has embedded in an object module. QuickBASIC programs compiled to object modules for use with the runtime library have a default library called BRUN30.LIB. Using the /NOD switch overrides the default and lets you specify another library name on the command line.

■ **NOIGNORECASE** tells BUILDLIB to treat upper- and lowercase letters in variable and routine names as distinct characters.

■ The syntax for the SEGMENTS switch is as follows:

```
/SEGMENTS:nnn
```

This feature allows you to have more than the default 128 segments in a user library. Actually, this tells BUILDLIB to limit the number of segments to whatever you have specified in *nnn* (decimal). *nnn* can be a number from 1 to 1024.

—Mark Novisoff

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■ PC LAB NOTES

probably have nothing to do with printing a string.

NOT TO WORRY With early versions of LINK, you had to pay careful attention to the order in which libraries were specified and even to the order of object modules within the library. If you had a CALL from one library that referenced a routine in another library that had already been read, LINK would generate an error message. Newer versions of LINK will rescans all libraries to try and resolve references before generating an error. If you do receive such error messages when you use LINK, consider upgrading your language product or your version of DOS in order to obtain a more up-to-date version of the LINK program.

LINK handles duplicate routine and object module names in what can only be called a straightforward way. LINK only "remembers" the first occurrence of a symbol; all later ones are ignored! To see an example of this in QuickBASIC 2, LINK the USERLIB.OBJ file with one of your programs. LINK will give you an error message because it finds two references to "ABSOLUTE", but your compiled program will run just fine. Although I don't recommend it, making use of this knowledge can be handy when you want to add a newer version of a routine to a program without removing the older version from a library. Suppose you have libraries

"A" (a small library) and "B" (a large library) and that library "B" contains an object module called FOO.OBJ. You've just added a new routine to FOO.OBJ, but you don't want to add it to library "B" until you've debugged the routine. By adding FOO.OBJ to library "A" and specifying your preferred order of linking, you can force LINK to include the new FOO in your program, thus:

```
LINK MyProg,,,A+B;
```

Since LINK finds FOO in library "A" first, it will simply ignore the FOO in library "B."

USER LIBRARIES QuickBASIC and Quick C provide the ability to create "user" libraries that can be accessed inside the compiler's "environment." QuickBASIC can also use this type of library when an executable program is run, while Quick C requires you to LINK the routines into the executable program.

The main disadvantages to user libraries are that the entire library must be in memory and only one user library can be accessed at a time. This means that all of the routines you CALL must be in the same library. The main advantage to user libraries is that the routines have already been compiled and therefore take much less memory than if they are included as source code.

In the case of QuickBASIC, there are additional advantages. By having your programs use them at runtime, less disk space is consumed. In addition, if a series of programs all use the same library, it is loaded only once.

CREATING A LIBRARY The first rule to follow when creating a library is to be absolutely sure that any routine you add is as "bulletproof" as possible. The most practical way is to write the code as a callable subroutine within a main program. This lets you modify the routine "on the fly," making it easier to check your shared variable types and ensure that the expected result occurs when you CALL the routine.

Does the routine jump out of a FOR/NEXT loop without completing the loop or without using some kind of "exit" statement? Do your video routines allow for use on a monochrome monitor as well as color? Are you passing a real number when you should be using an integer?

The point is that you should thoroughly test your routine before putting it into a library. Don't fall into the trap of testing it only with valid arguments; always consider what happens when an invalid value is passed to the routine. What does it do when a zero is passed as a value or as the length of a string? My own approach is to write a "main" program whose sole purpose is to "exercise" the library routine. I write the library routine as a "subpro-

USEFUL ENVIRONMENT VARIABLES

Most of us use DOS "Environment Variables" whenever we use our computer. The most common is the DOS "PATH". Several recent Microsoft language products can make use of environment variables by simply setting them at the DOS prompt or in a batch file.

THE LIB VARIABLE Programs such as LINK, C, Quick C, QuickBASIC, and BUILDLIB can be made to search the current directory and then a specified path whenever a library name is encountered. Just as with the PATH variable, the various subdirectories are separated with semicolons. For example:

```
SET LIB=C:\DOS\LIB;C:\MSH;C:\MSK
```

QuickBASIC makes use of this variable when any libraries are needed. This includes the runtime library BRUN30.EXE as well as user libraries. You do not need a copy of BRUN30.EXE or your user libraries in every directory where you have compiled programs.

THE INCLUDE VARIABLE If you work with Microsoft's Macro Assembler 5.0, MS C 5.0, or Quick C, you can set the INCLUDE variable that these programs will use whenever an include file is called for. The syntax is the same as the

PATH and LIB variables; only the name changes:

```
SET INCLUDE=C:\DOS\INCLUDE;C:\LIBS
```

THE TMP VARIABLE Should the LINK program run out of memory during execution, it creates a file called VM.TMP (in older versions) to store some intermediate values. You can tell LINK the drive and path to use for this file by setting the TMP variable:

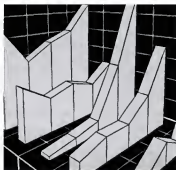
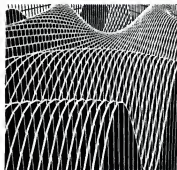
```
SET TMP=E:\
```

My drive E: is a RAMdisk, so this enables LINK to operate much faster than if it were to create the file on a hard disk.

—Mark Novisoff

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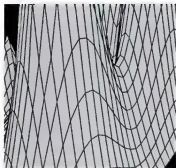
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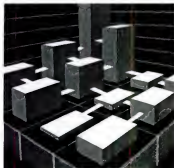
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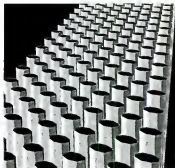
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■ PC LAB NOTES

gram" in QuickBASIC. Figure 1 contains an example.

The purpose of the library routine in the figure is to make sure that a given string (AS) is exactly N% characters in length and that the first letter of the string is capitalized. If AS is longer than the value of N%, the string is truncated. If it's shorter, AS is padded with CHR\$(P%) so that its length becomes 30.

The test program first calls the routine with a "normal" string (Test1), then calls it again with a zero length string (Test2), and finally with a string that is longer than N% (Test3).

Test2 is necessary to ascertain how my program handles the null string. If I don't provide code to check for this situation, trying to figure out what the first character is will cause an error.

Since I'm using a parameter list in my CALL to the subprogram, I can include my subprogram in a user library without changing the routine or the CALL to it. This makes it very easy to test the routine after I've added it to my user library.

AFTER ADDING TO A LIBRARY Using the test program in Figure 1 as an example again, I move the subprogram to a separate program and compile it to an object module. Then I use BUILDLIB to create a user library from the file. Finally, I take my mainline code without the subprogram and compile it using my new user library to make sure that the routine works.

Don't make the mistake of thinking that "it worked OK in my program so that means it will work OK when called from the library." In the real world, things just don't happen like that. In the example above, for instance, in place of the parameter list in the line

```
Sub ConvertString(AS,N%,P%) Static
```

you might be tempted to substitute a SHARED statement, thus:

```
Sub ConvertString Static
Shared AS,N%,P%
```

The program will work just fine when it's all together as source code. But if you separate the subprogram and put it into a user

library, it won't work. If you don't know why it won't work, see the sidebar "Using Libraries Inside and Outside the QuickBASIC Environment" under the explanation of local and global variables.

ASSEMBLING A WORKING LIBRARY

Figure 2 shows a QuickBASIC (Version 2 or 3) program (MAINPROG.BAS) that demonstrates the use of subprograms and an assembly language subroutine. The principles involved here can be applied to any language that allows you to use the library concept. In order to use this program, you'll need not only MAINPROG.BAS, but SUBPROG1.BAS (Figure 3), SUBPROG2.BAS (Figure 4), and EGAINFO.ASM (Figure 5), as well.

To create libraries from the routines, the subprograms must first be compiled into object modules thus:

```
QB SUBPROG1;
```

```
QB SUBPROG2;
```

The semicolon on the end of the line tells QuickBASIC to perform the compilation

REM TEST.BAS - Mainline code for testing
REM ConvertString Subprogram

```
Test1:  AS="string to be padded"
        N%=30
        P%=" "
        Call ConvertString(AS,N%,P%)
        Print "1" AS "1"
```

```
Test2:  AS=""
        Call ConvertString(AS,N%,P%)
        Print "2" AS "2"
```

```
Test3:  AS=string$(40,"a")
        Call ConvertString(AS,N%,P%)
        Print "3" AS "3"
End
```

REM This is the routine that
REM will go in the library

```
Sub ConvertString(AS,N%,P%) Static
```

```
If Len(AS)>N% Then
    AS=Left$(AS,N%)
Else
    AS=AS+string$(N%-Len(AS),P%)
End If
```

```
If AS="" Then
    AS=Left$(AS,1)
    If AS="" And AS<=" " Then
        Mid$(AS,1,1)=Chr$(Asc(AS)+32)
    End If
End If
```

```
End Sub
```

Figure 1: Sample "main" program for testing a library routine.

' Mainprog.bas is the "main program" giving you an example of how to
' call subprograms.

' The program calls two subprograms to find out if a color or monochrome
' monitor is active (Subprog1) and to find out if a Hercules adapter
' is in the system (Subprog2)

CALL Find_monitor(Monitor,segment\$,Egadget\$,Ngcolum\$,Egacrow\$,Egastatus\$,Egagend\$)
CALL Hercules.there(Hercules.status\$)

```
PRINT "The currently active monitor is on a ";
IF Monitor.segment$ = "Hercules" THEN
    PRINT "Monochrome adapter."
ELSE
    PRINT "color graphics adapter."
END IF
```

```
IF Egastatus$ = "-1" THEN
    PRINT "There is no EGA or VGA card present."
ELSE
```

```
IF Egastatus$ > 9 THEN
    AS = "VGA"
    Egastatus = Egastatus - 10 ' don't need the added 10 anymore
ELSE
    AS = "EGA"
END IF
```

```
PRINT AS; "is present on ";
IF Egastatus = 1 THEN PRINT "monochrome mode." ELSE PRINT "color mode."
PRINT "The current video mode is"; Egagend$
PRINT "The monitor is displaying"; Ngacolum$; "columns ";
PRINT "and"; Egacrow$; "rows."
PRINT AS; "card has"; Egagend$; "bytes of memory."
END IF
PRINT
```

```
IF Hercules.status$ = 0 THEN
    PRINT "There is no Hercules adapter in this system."
ELSE
    PRINT "There is a Hercules or compatible adapter in this system."
END IF
```

Figure 2: The main program that calls library subroutines and interprets the results.

without bringing the interactive editor into action. The EGAINFO.ASM routine must be assembled to an .OBJ file using the macro assembler and the command

```
MASM EGAINFO;
```

CREATING A LINK LIBRARY You can create a link library using the LIB program thus:

```
LIB MYLIB+SUBPROG1+SUBPROG2+EGAINFO;
```

The final step is to compile the main program and LINK it with our new library:

```
QB MAINPROG;
LINK MAINPROG,,,MYLIB;
```

The result is a file called MAINPROG.EXE, which is executable from the DOS command line by typing in MAINPROG and pressing the Enter key.

A QUICKBASIC USER LIBRARY User libraries are created with the BUILDLIB program. The details are discussed in the sidebar, "QuickBASIC User Libraries: How to Use BUILDLIB," but the basic command form is

```
BUILDLIB SUBPROG1+SUBPROG2+EGAINFO;
```

To use the new library, you start up QuickBASIC with the /L switch, thus:

```
QB MAINPROG/L
```

SAMPLE PROGRAMS: HOW TO DETECT VARIOUS VIDEO ADAPTERS MAINPROG calls two subprograms that provide information about the type(s) of monitors currently attached to the system. It then interprets and displays the results of the calls to the subprograms.

SUBPROG1 (Figure 3) checks the "equipment flag" in the BIOS data area to determine whether the currently active monitor is monochrome or color. In addition, the program calls an assembly language subroutine (EGAINFO) to find out if a VGA or EGA is in the system. If so, more information is returned by the routine.

EGAINFO.ASM (Figure 5) is written so that it can be used by QuickBASIC, Turbo Basic, and interpreted BASIC. In the latter case, the resulting .COM file must be converted for inclusion in an inter-

preted BASIC program (see EGAINFO.ASM). If you are using Turbo Basic, you'll need to modify the subprograms to be used as "inline files" and download EGAINFO.BIN. Alternatively, you can download the source code file, EGAINFO.ASM, and change the TURBOBASIC equate to 1 before converting it to a .BIN file.

EGAINFO first calls a BIOS service unique to VGA systems. If a VGA is found, 10 is stored in the DX register to be added to the value of EGASTATUS% later. This allows you to differentiate between a VGA and EGA. It then calls an EGA BIOS service (function 12h) that returns information about the adapter, if there is an EGA or VGA in the system. If neither is present, the value of 10h in the BL register is unchanged, since function 12h is not a normal BIOS function.

SUBPROG2.BAS (Figure 4) contains a routine that is used to determine if a Hercules (or compatible) adapter is present.

Because there is no BIOS support for the Hercules adapter, sometimes two or three tests must be performed.

The Hercules status port is polled to see if the value in bit 7 changes. If no change is detected, no Hercules card is present. The second test tries to change a word (2 bytes) of video memory at an offset 32K into the memory segment. If the word can be successfully changed, a Hercules card is present. If test 2 was unsuccessful, it is repeated after telling the Hercules card to allow graphics only on video page 0. This is done in case the card was in "diagnostic mode" when test 2 was performed.

DOCUMENTATION IS IMPORTANT

This advice is almost as often ignored as given, but just as with applications programs, creating complete documentation for your libraries will save you many hours of frustration. You'll appreciate good documentation most when you want to call a seldom-used routine, when you discover a

```

' File Name: SUBPROG1.BAS
' Routines : Find_monitor

' Written : 07/25/87 by Mark Soviaoff
' Changes : 07/29/87 by Mark Soviaoff - added code to detect VGA
' Comments : Requires EGAINFO.OBJ (source is EGAINFO.ASM)

Sub Find_monitor (Monitor.segment%, EgaMode%, EgaColumns%, EgaRows%, EgaStatus%, EgaMem%) Static

' Description - Determines if a monochrome or CGA adapter is active and
' if an EGA or VGA monitor is in the system.
' After calling this routine, check EgaStatus to determine if an EGA is
' present in the system. If so, the other variables are set as described
' below.

' The following variables are available to the main program:
' Monitor.segment% is &h0000 for monochrome or &h0000 for color.
' EgaMode% is the current video mode
' EgaColumns% is the number of columns displayed on the screen (text modes)
' EgaRows% is the number of rows displayed on the screen (text modes)
' EgaStatus%: If -1, no EGA or VGA is present
' If 1, EGA is in monochrome mode
' If 2, EGA is in color mode
' If 3, EGA is present, 18 is added to EgaStatus% of 0 and 1
' EgaMem% is the amount of memory on the EGA adapter (in Kbytes)

' First we'll look at the BIOS equipment flag to determine if a CGA or
' monochrome adapter is active.

Def Ega=&0000 ' BIOS data area
If (peek(&E0) and &030=&030) then
  Monitor.segment%=&h0000
else
  Monitor.segment%=&h0000
End If
Def Ega ' back to BASIC's default segment

' Call our assembly language subroutine - requires EGAINFO.OBJ
Call EgaInfo(EgaMode%, EgaColumns%, EgaRows%, EgaStatus%, EgaMem%)

End Sub

```

Figure 3: A subprogram that detects any of the IBM standard video adapters.



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DOS 3.3 Commands

This DOS 3.3 Command Summary contains some commands and syntax that differ from prior or non-IBM versions of DOS. Commands marked with an asterisk (*) are external programs.

FIND *—Filter, find matching lines

SYNTAX: **FIND** [/V] [/C] [/N] "string" [[d:] [path] [filename], ext].

/V — select lines not containing string
/C — display count of matching lines
/N — display line number of matching lines
"string" — search string in double quotes
[d:] [path] [filename], ext — file(s) to search

FORMAT *—Prepare new disk

SYNTAX: **FORMAT** a: [/S] [/T] [/B] [/V] [/B] [/4] [/N:xx] /T:yy

a: — drive with disk to format
/S — copy system files to new disk
/1 — single-sided
/B — 8 sectors per track
/V — give volume label
/B — 8 sectors per track, space for system
/4 — format single/double sided in 12-Mbyte drive
/N:xx — xx sectors per track
/T:yy — yy tracks on the disk

GRAFTABL *—Load high-ASCII graphics table

SYNTAX: **GRAFTABL** [437|860|863|865|STATUS]

437 — United States code page
860 — Portuguese code page
863 — Canada (Fr.) code page
865 — Norway/Denmark code page
/STATUS — show current code page

GRAPHICS *—Allow graphics PrtSc

SYNTAX: **GRAPHICS** [printer type] [/R] [/B] [/LCD]

[printer type] COLOR1 — IBM Color Printer with black ribbon
COLOR4 — IBM Color Printer with red, green, blue, black
COLOR8 — IBM Color Printer with black, cyan, magenta, yellow
COMPACT — IBM Compact Printer
GRAPHICS — IBM Graphics Printer or Proprinter
THERMAL — IBM Convertible Printer
/R — reverse black and white
/B — print background color (COLOR4, COLOR8)
/LCD — print from IBM Convertible LCD display

JOIN *—Join drive with directory on other drive

SYNTAX: **JOIN**

—or—

JOIN a: c:\directory —or— **JOIN** a: /D

a: — drive to join
c:\directory — directory to join to
/D — disconnect a JOIN
/DOTE JOIN without parameters displays JOIN status

KEYB *—Load non-U.S. English keyboard

SYNTAX: **KEYB** [xx, [yyy], [[d:] [path] [filename], ext]]

xx — keyboard code
yyy — code page for character set
[d:] [path] [filename], ext — location of KEYBOARD.SYS

LABEL *—Set volume label

SYNTAX: **LABEL** [d:] [volume label]

d: — drive to label
volume label — up to 11 characters

MKDIR (MD) —Make a subdirectory

SYNTAX: **MKDIR** [d:] [path]

[d:] — drive for new subdirectory
path — subdirectory to make

MODE *—Set printer mode

SYNTAX: **MODE** LPT #: [/p] [/m] [,P]

— printer number (1, 3)
n — characters per line (80 or 132)
m — vertical lines per inch (6 or 8)
P — continuous retry on timeout

MODE *—Send printer output to COM port

SYNTAX: **MODE** LPT #: = COMx

— printer number (1, 3)
x — COM port number (1, 4)

MODE *—Set video mode

SYNTAX: **MODE** a

—or—

MODE [e], [m], [T]

n — video mode (40, 80, BW40, BW80, CO40, CO80, MO80)
m — R or L; shift display right or left
T — show test pattern for aligning display

MODE *—Set serial communication mode

SYNTAX: **MODE** COM #: [[baud], [parity], [databits], [stopbits], [P]]

— COM port being set (1, 4)
baud — baud rate (110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200)
parity — N, O, or E for None, Odd, Even (default Even)
databits — 7 or 8 (default 7)
stopbits — 1 or 2 (default 2 if 110 baud, 1 if not)

P — continuous retry on timeout when COM port is in use by serial printer

MODE *—Prepare code pages

SYNTAX: **MODE** device CODEPAGE PREPARE = ((cp1)at) [d:]

[path] [filename], ext]

device — one of CON, PRN, LPT1, LPT2, LPT3
cp1at — code page number or list of numbers (437, 850, 860, 863, 865)
[d:] [path] [filename], ext — file containing code pages

MODE *—Select code page

SYNTAX: **MODE** device CODEPAGE SELECT = cp

device — one of CON, PRN, LPT1, LPT2, LPT3
cp — code page (437, 850, 860, 863, 865)

MODE *—Display active code page

SYNTAX: **MODE** device CODEPAGE [STATUS]

device — one of CON, PRN, LPT1, LPT2, LPT3

MODE *—Refresh code page

SYNTAX: **MODE** device CODEPAGE REFRESH

device — one of CON, PRN, LPT1, LPT2, LPT3

MORE *—Filter; pause output each screenful

SYNTAX: **MORE**

NLSFUNC *—Support extended country info

SYNTAX: **NLSFUNC** [[d:] [path] [filename], ext]

[d:] [path] [filename], ext — country information filename

PATH—Search directory list for programs

SYNTAX: **PATH** [[d:] [path] [, [d:] [path], ...]]

—or—

PATH

[d:] [path] — drive/path for search list

: — none; resets search path to null

NOTE: PATH without parameters shows PATH string

PRINT *—Background printing

SYNTAX: **PRINT** [D: device] [B: baud] [U: busytick] [M: maxtick]

[S: timeslice] [Q: queue] [C: /T] [P] [[d:] [path] [filename], ext], ...]

D: device — print device (default PRN)
B: baud — set bytes for internal buffer (default 512)
U: busytick — set ticks to wait for printer available (default 1)
M: maxtick — set ticks to use for printing (1, 255, default 2)
S: timeslice — set time slice value (1, 255, default 8)
Q: queue — set how many files can be in print queue (1, 32, default 10)

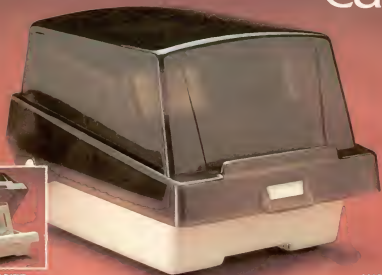
C — cancel preceding file and all files until a /P

T — terminate; cancel entire print queue

P — print preceding file and all files until a /C

[d:] [path] [filename], ext — file to print

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■ PC LAB NOTES

```

* File Name: SUBPROG02.BAS
* Author: Hercules, Inc.
* Written: 07/25/87 by Mark Hestoff
* Change: none
* Comments: none

```

```

SUB Hercules.there (Hercules.status) STATIC

```

```

* Description - Determines if a Hercules card is in the system
* After calling this routine, Hercules.status is 0 (no adapter present)
* or 1 (adapter is present).

```

```

Hercules.status=0
Status.port=0320
Old.status=IPP(status.port)
Old.status=Old.status AND 4095
FOR B=1 TO 4095
    New.status=IPP(status.port)
    New.status=New.status AND 4095
    IF New.status=Old.status THEN
        status=0
        END IF
    ELSE
        status=1
        END IF
NEXT B
IF New.status=Old.status THEN
    EXIT SUB
END IF
Try.chance=chance

```

```

* Hercules.status=0
* Status.port=0320
* Old.status=IPP(status.port)
* Old.status=Old.status AND 4095
* For B=1 to 4095
*   New.status=IPP(status.port)
*   New.status=New.status AND 4095
*   If New.status=Old.status then
*       status=0
*   else
*       status=1
*   end if
* Next B
* If New.status=Old.status then
*     Exit sub
* End if
* Try.chance=chance

```

```

* get the variable to 0
* the Hercules status port
* get the current status
* isolate bit 7 for comparison
* should be enough tests
* get the current status
* isolate bit 7 for comparison
* if the status changes
* then it probably is a Hercules card
* so set the loop
* Note that in QB 3.0, you can say
  "Exit for" instead of "Exit"

```

```

* and read back the same value, then
  there must be 128K of memory and
  a Base (or compatible) is present

```

```

Def key=4095
low.byte=Peek(ah20)
high.byte=Peek(ah21)
Poke ah20,low
Poke ah21,high

```

```

If Peek(ah20)=high and Peek(ah21)=low then
    Hercules.status=1
    Data Hercules.there
    End If

```

```

* This is a second test in case the memory test above failed because the
  Hercules adapter was in "diagnostic" mode.

```

```

Config.port=0320
Get Config.port,1

```

```

* the Hercules configuration port
* Allow graphics only on page 0
* Now try to change it again

```

```

Poke ah20,low
Poke ah21,high

```

```

If Peek(ah20)=high and Peek(ah21)=low then
    Hercules.status=1
    End If

```

```

* If the change "sucks", then there is there
  and so we are finished

```

```

Hercules.there=1
Poke ah20,low.byte
Poke ah21,high.byte
Def key

```

```

* put it back the way it was
* data
* BACK TO BASIC'S DEFAULT REQUEST

```

```

End sub

```

```

* If we can change a word in memory

```

Figure 4: This subprogram manipulates the hardware directly to locate a Hercules monographic's adapter.

```

* SUBROUTINE designed to be used with compiled or
  interpreted BASIC. See the sample programs BAIINFO.BAS and
  SUBPROG01.BAS which show you how the routine is implemented in
  your program.

```

```

* This routine can be used as is for IBM and Microsoft BASIC, whether
  compiled or interpreted.

```

```

* For compiled IBM/MS BASIC, all you have to do
  is assemble this code to create BAIINFO.OBJ and then LINK the module
  with your program (or include in a new library). Assemble it like this:
  IBM BAIINFO

```

```

* Then compile and LINK as shown below. If you are using QuickBASIC 1.0 or
  either version of IBM's compiler, substitute BASCOM for QB.

```

```

* QB Yourprog
* LINK Yourprog+BAIINFO

```

```

* If you are using Borland's Turbo Basic, you'll need to perform
  the following steps:

```

```

1. Use the following commands to create a .BIN file:
  NAME BAIINFO
  LINK BAIINFO
  EXE2BIN BAIINFO BAIINFO.BIN
  DEL BAIINFO.EXE

```

```

2. In your program, have a line that says:
  Goto "info.bin"

```

```

3. Change the following sequence to it:

```

```

TURBO_BASIC EQU 0

```

```

* Note that it is very important that you use only integer variables when
  calling the routine, since other types of variables can cause problems.

```

```

* The syntax for calling this routine is:

```

```

CALL BAIINFO(BGAMODES,BGACOLUMNS,BGAROWS,BGASTATUS,BGABANK)

```

```

* After calling the routine, check the variable BGASTATUS. If it
  is -1, there is no VGA in the system. If not -1, the variables
  contain the following information:

```

```

BGAROWS is the current video mode.
BGACOLUMNS is the number of columns on the screen, if in text mode.
BGAROWS is the number of rows on the screen, if in text mode.
BGASTATUS is 0 if in color mode, 1 if in monochrome mode or
  -1 if no VGA is present.
For VGA monitors, 10 is added to 0 or 1. In other words, if
  10, VGA is color mode. If 11, VGA is mono mode.
BGABANK is the amount of memory on the VGA card in kilobytes.

```

```

CODE SEGMENT PARA PUBLIC 'CODE'
ASSUME CS:CODE,DS:MOVING,SI:MOVING,BI:MOVING

```

```

* Register - substituted literally when assembled

```

```

IF TURBO_BASIC
    BGAROWS EQU 22
    BGACOLUMNS EQU 18
    BGAROWS EQU 14
    BGASTATUS EQU 10
    BGABANK EQU 8
ELSE
    BGAROWS EQU 14
    BGACOLUMNS EQU 12
    BGAROWS EQU 10
    BGASTATUS EQU 8
    BGABANK EQU 8
ENDIF

```

```

PUBLIC BAIINFO
BAIINFO PROC FAR

```

```

TURBO BP
MOV BP,SP

```

```

* save this register
* for addressing variables

```

```

TURBO BI
TURBO DI
TURBO SI

```

```

* necessary for QB 4
* necessary for QB 4
* size changes this

```

```

MOV SI,[BP+BGASTATUS]
MOV WORD PTR [SI],-1

```

```

* point to BGASTATUS
* Assume as VGA

```

```

MOV DI,0
MOV AL,BI
INT 10

```

```

* Assume as VGA
* Check for VGA
* Call the BIOS

```

```

CMP AL,10h
JNE F1ND_VGA
CMP AL,7
JZ FOUND_VGA
CMP AL,0
JNE F1ND_VGA

```

```

* If still IAN, no VGA
* No VGA, but maybe VGA
* Make sure it's a VGA
* If B=0 or 8, it's a VGA

```

```

* If not, try to find VGA

```

```

FOUND_VGA:
MOV DI,10
VGA:
MOV AX,120
MOV BX,100
PUSH BP
INT 10
POP BP

```

```

* service 120
* get BGA information
* Name BGA's destroy this
* call the BIOS routine
* retrieve SP pointer

```

```

CMP BI,100
JZ NO_VGA

```

```

* did it change?
* so, leave with -1 status

```

```

NO_VGA:
MOV AX,00
INX AX
AND AX,0F
MOV BI,[BP+BGASTATUS]
MOV WORD PTR [SI],AX

```

```

* save color/mono setting
* clear high bits of status
* Add VGA status
* point to variable
* pass to BASIC

```

```


```

(Figure 5 continues)

Figure 5: This assembly code routine is used to determine if an EGA or VGA is present.

■ PC LAB NOTES

INC	AX,AX	; clear high bite	MOV	AX,AX	; number of columns
INC	AX	; now 1=64, 2=128, etc.	MOV	AX,AX	; clear high bite
MOV	DX,0	; multiply by 64	MOV	SI,(BP+BASECOLUMN)	; point to variable
SHL	AX,CL	; shift bits to the left.	MOV	WORD PTR [SI],AX	; pass to BASIC
MOV	SI,[BP+BASE]	; point to variable			
MOV	WORD PTR [SI],AX	; pass to BASIC	MOV	AX,AX	; clear high bite of mode
			MOV	SI,(BP+MODENUM)	; point to variable
MOV	AX,11288	; "Get pointer" service	MOV	WORD PTR [SI],AX	; pass to BASIC
PCBB	SP	while service changes SP	DATA_EXIT:		
INC	SP	return number of rows	POP	SI	
POP	SP	restores register	POP	SI	; for qd 4
INC	DI	return number rel. to 0	POP	SI	; for qd 4
SHL	AX,05	; clear high bite	POP	SP	; restore for BASIC
MOV	SI,(BP+BASECOLUMN)	; point to variable	IF TURBO_BASIC	EQ	0
MOV	WORD PTR [SI],AX	; pass to BASIC	ENDF	IF	
					; clean up stack and return
PCBB	SP	; save in case destroyed			
MOV	AX,0FH	; get video mode	MOV	AX,0FH	
INT	10	; call the BIOS	CODE	ENDP	
POP	BP	restores register	END		

(Figure 5 ends)

bug, and when you want to add a feature to a routine. Without such reference material, your routines might be useless in the future.

You should document the source code in detail and summarize the same data in a file describing the library. Figures 3 and 4 (SUBPROG1.BAS and SUBPROG-2.BAS) show what should be the minimum documentation in a source module:

- The name of the routine(s) that are in the module.
- The name of the original programmer and the date the file was created.
- The date(s) when modifications were made, together with the programmer's name and a description of the changes.

For each routine in the module, you should include a description of what the routine does, together with any special

comments or requirements. Suitable documentation for the sample user library might look like the table "Suggested User Library Documentation." If you really want to do it right, include the calling syntax and variable usage in the library description, together with the source files.

When you change a routine in a runtime or user library, QuickBASIC requires that all programs using the library be recom-

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USER LIBRARIES WITH QUICKBASIC 4.00

The main body of this issue's Lab Notes was written prior to the announcement of QuickBASIC 4.00 by Microsoft. While the advantages of using libraries are still very real, the creation, maintenance, and use of runtime libraries with QuickBASIC has changed considerably for the new version.

I'll discuss the changes made in QB4 and refer to user libraries by their new name, "Quick libraries."

■ *Quick libraries now work only within the QB environment.* To many programmers, this is an unwelcome change. You will no longer be able to place commonly used routines in a library that is shared by your applications programs. Rather, the Quick library is now viewed strictly as a development tool and works only when you have QuickBASIC in memory.

The drawbacks to this are more diskettes to distribute your software and larger .EXE files that take longer to load.

You still load Quick libraries with the /L switch, but they now carry a default extension of .QLB instead of .EXE. The default library name is now QB.QLB.

■ *Creating libraries from within the environment.* If your Quick libraries consist only of QuickBASIC code, and you have enough memory available to load all of your subprogram modules into QuickBASIC, you can create both Quick and link libraries without exiting from QB's environment.

Load your routines, one after another, until they are all in memory, and then tell QB to create your libraries. It does so by SHELLing the LIB and LINK programs, both of which are now included with QB.

If you don't have enough memory, or if you have library routines created using other languages, you will need batch files to handle the library creation functions.

Note that the library file BQLB40.LIB, which is supplied by Microsoft, must be present when a Quick library is created. If it's not in the current directory or path specified by the LIB environment variable, you'll get an error message. When you use LINK to create Quick libraries, specify this file in the "library" field. For example:

```
LINK /Q @MySubs.dat,,,BQLB40;
```

■ *You can no longer convert link libraries to Quick libraries.* In the sidebar "QuickBASIC User Libraries: How to Use BUILDIB," I explained that link libraries can be converted to user libraries. QB 4.00 uses LINK to create the Quick libraries and LINK does not support the /LIB switch. Quick libraries can be built only from object modules.

■ *Multiple language support.* Quick and link libraries can make use of virtually all Microsoft languages. This includes Assembler, C, Quick C, Pascal, and Fortran. Believe it or not, the calling of subprograms now works in both directions.

For example, a program written in C can call a QB subprogram.

■ *SUB..END SUB cannot be used in include files.* The whole concept of "load" has changed with QB 4.00. You can now load multiple modules into memory at the same time. To incorporate subprograms into your program, you must "load" or "merge" the subprogram files instead of "including" them. But the additional features that work along with the new "load" concept far outweigh the minor disadvantage of not having SUB..END SUB in the include files.

■ *Global functions.* In the new FUNCTION..END FUNCTION procedure, you can now have user-defined functions that are available to your main program and all subprograms. As with SUB..END SUB, these functions cannot be in include files.

■ *Quick libraries can have debug code.* This code deals mostly with array bounds checking, overflow, and Ctrl-Break checking. If you use this feature, the addition of debugging code to your library causes it to be larger.

■ *Contents of Quick libraries can be viewed.* Microsoft provides a program called "QLBDUMP.BAS" that lets you view the names of all public symbols in your Quick libraries. With QB 2 and 3, once a user library was built, there was no way of telling what was in it.

—Mark Novisoff

piled. This is because the locations of the routines within the user library are "hard coded" into your programs. With a link li-

brary, you need to recompile only the programs that use the modified code, since the routines in other programs are already in-

cluded in the executable file.

Creating and using libraries can save you a great deal of time and effort by eliminating reprogramming and subsequent mistakes. You can generate your own libraries with the tools and guidelines presented here, or you can purchase them from independent software developers. As your programs become more complex, a judicious choice of user libraries will help you reap the maximum benefit from your programming effort. So, check out user libraries, and make your programming time more productive. ☐

Mark Novisoff is the president of Micro-Help Inc.

Suggested User Library Documentation

Library name: USERLIB.EXE
Library type: QB User Library

Source File	Routines Included
SUBPROG1.BAS	Find.monitor—Detects color/mono monitor and presence of EGA/VGA. Requires EGAINFO.OBJ from EGAINFO.ASM. Hercules.there—Detects presence of Hercules.
SUBPROG2.BAS	Assembly routine required by SUBPROG1.BAS.
EGAINFO.ASM	

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■ UTILITIES ■ MICHAEL J. MEFFORD

THE COMPLEAT COPY UTILITY

CO lets you tag and copy, move, or delete groups of files, changing floppies in midstream and using sorted directory listings, while retaining all the options of COPY.

What do you do before you even run a new piece of software? You COPY it to a backup floppy, to your hard disk, or to both. Before you patch a program or modify an important file, you COPY it to a different name and do your work on the clone. You transfer data files to other directories or to other colleagues with COPY. Next to DIR, COPY is probably your most-used DOS command.

Like DIR, however, the DOS COPY command is not as sharp a file management tool as it ought to be. For one thing, it involves a lot of filename typing, and a single errant keystroke produces either a "file not found" message or a misnamed copy. (Only keyboard acrobats who don't need them could be happy with the F1 and F3 editing capabilities DOS provides.) If you're lucky, the DOS wildcards help. You're out of luck, however, if you need to back up only your most recently created files. And you're in worse shape still if you need to COPY *.* from a large hard disk directory to a series of floppies.

Who needs the hassle when you can use CO.COM instead? CO gives you a listing of any directory, sorted to taste; lets you pick out one or a number of files to COPY, MOVE, or DEL; makes the most efficient use of floppies, and lets you change them as needed when backing up large numbers of files.

The easiest way to get a copy of CO.COM is to download it, gratis, from the PC Magazine Interactive Reader Service, as explained in the accompanying sidebar "CO by Modem." If you haven't a phone

(which is the only good reason for not having a modem these days), you can keyboard and assemble CO.ASM, the source code, or type in and run CO.BAS. These programs are printed elsewhere in this article, and they are also available for downloading via PC-IRS.

BEYOND DR A number of readers who obtained my earlier DR directory utility (Volume 6 Number 14) have wondered why I didn't include the all-important COPY function in that program. The omission was not an oversight. As the length of the assembler listing for CO suggests, what we take for granted when we enter COPY at the DOS prompt is a rather

difficult and lengthy command to program. Adding COPY to the list of DR's functions would have made it grow out of proportion.

You can get a hint of the required complexity (it's explained more fully below in the section "Understanding CO") from considering the different ways you can enter the COPY command. In its most straightforward syntax, you tell DOS explicitly to copy one file to another, e.g.,

COPY A:\MYFILE C:\MYFILE

However, if the default drive is C:, you can achieve the same result with the implicit **COPY A:\MYFILE**. You can also give a



Directory of B:\					
COMMAND	COM	25924	9-10-87	3:38p	A
COUNTRY	SYS	11428	2-09-87	12:38p	A
+DISPLAY	SYS	11184	2-09-87	12:38p	A
+DRIVER	SYS	1926	9-15-87	8:22a	A
+EGA	CPI	59537	9-16-87	12:44p	A
FASTOPEN	EXE	6355	2-09-87	12:54p	A
FDISK	COM	969	8-07-87	1:57p	A
+FORMAT	COM	6150	4-02-87	1:55p	A
+IMBIO	COM	27553	9-15-87	8:38a	A
IMBIO	COM	37828	9-18-87	1:28p	A
KEY	COM	9124	5-01-87	5:09p	A
+KEYBOARD	SYS	16304	3-10-87	12:00p	A
+LCB	CPI	11488	4-13-87	4:36p	A
+MODE	COM	13258	2-11-87	2:41p	A
MSFUNC	EXE	8642	6-01-87	18:53a	A
PRINTEX	SYS	13372	4-08-87	3:53p	A
+REPLACE	EXE	2362	6-05-87	11:34a	A
+SELECT	COM	48728	4-08-87	2:44p	A
SYCS	COM	3987	9-17-87	5:12p	A
VBISX	SYS	3991	9-18-87	1:26p	A
+VENDOR	DO1	456	6-05-87	11:35a	A
21 File(s)		38912 bytes free			

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F1 Copy
F2 Delete
F3 Move
F4 Clear marks
F5 Mark blank
F6 Verify OFF
F7 Sort by Name
F8 Sort by Ext.
F9 Sort by Size
F10 Sort by Date
+/- Mark/Unmark
Esc to Exit

Use: 1 J PgUp PgDn
PgUp PgDn Home End

Copy 11 marked files to...

A CO disk directory display. F1 copies marked files to any disk or directory you specify.

■ UTILITIES

file a new name at the same time you copy, as in

```
COPY A:\OLDNAME A:\NEWNAME
```

But what happens if NEWNAME already exists? An elementary-looking command like this can quickly get complicated. If NEWNAME exists, DOS has to make sure before copying that the length in bytes of OLDNAME does not exceed the length of NEWNAME plus the balance of bytes free on disk. Otherwise, DOS would blindly start copying over NEWNAME and run out of disk space before the task was accomplished, effectively wiping out NEWNAME. The global characters add another dimension of difficulty: we know what COPY *.BAK A: should do, but programming it is a nightmare you will fortunately not have to endure.

CO thus picks up its task where the DR utility left off, and it incorporates the same look and feel. The command syntax is also the same:

```
CO {d:}[\directory]{/F}{/S}{/D}{/T}{/O}
```

Entered without parameters, CO presents you with an alphabetized listing in DOS format of your current directory on the left side of the screen, and with a menu of options on the right. Add a drive and/or directory if you want to copy (or move or delete) files from a directory other than the default. The command line switch characters tell CO which way it should sort your directory initially. CO defaults to sorting alphabetically by filename. The /E switch instructs CO to sort by Extension. Either a /D or a /T sorts by DaTe, and /S sorts by Size. The /O stands for Original DOS DIR order. Don't worry if you can't remember the switches. All the sort functions except /O appear in CO's menu.

COMPLETE CONTROL Unlike the DOS DIR command, which scrolls off into never-never land, CO gives you complete control over the directory listing display with the keypad direction keys. The Up and Down Arrow keys move the highlight bar a line at a time, while PgUp and PgDn flip to the next page of the 21 filenames CO displays at any one time. The Home and End keys take you to the beginning and end of the directory, and Ctrl-PgUp

and Ctrl-PgDn take you to the top and bottom of the current page. CO also has a first-letter-of-filename search feature that lets you quickly navigate to a specific file. Pressing P, for example, takes you to the first file that starts with the letter P. Another press of P and you will arrive instantaneously at the next P file. A beep indicates

■ CO picks up its task where the DR utility left off, and it incorporates the same look and feel.

that no more P files were found.

When you highlight a filename in the directory listing and press F1 (Copy), CO prompts you for the destination. You have all the same familiar DOS COPY options here, so it's unnecessary to enumerate them all. What you can't do with COPY but you can do with CO, however, is use the numeric keypad Plus key to mark (and the Minus key to unmark) a group of files to be copied en masse when you then hit F1. If (as is the usual case) the files are to retain their original names, all you need supply is a path designation. You can add *. * to the path if you like, but it isn't necessary. CO copies to the current directory if you don't provide another destination. The one thing to avoid is giving a single filename as the destination for a group of files—they'll all be successively copied over the same target file. You can, however, enter a filespec such as *.BAK to make backup copies. The global ? wildcard is also supported.

As each file is successfully copied, an asterisk is placed in front of the listed source filename. Any time that you wish to abort a process, just press the Esc key. Pressing Esc while in the listing window will exit CO and return you to the DOS prompt. Any keypress during the copying of marked files will act as a rip cord: the copying will cease after the current file being processed is completed. If there is not enough disk space for a marked file, it is skipped and succeeding marked files are

checked to see if any will fit. When the target disk space has been filled as much as possible, the copied files retain their asterisk and the uncopied but marked files retain their marker-arrow; so you just change disks, hit F1, and indicate the destination drive again.

F4 clears all marks (both arrows and asterisks) attached to filenames and F5 marks all unmarked filenames for block operations. F5 will not mark files that have a copy-confirmed asterisk in front of them. What F5 does is enable you to split up a directory into two different target disks or directories. You first mark the files destined to go to the first directory and copy them. All the arrow marks will turn to asterisks after completion. Pressing F5 then marks all the rest of the files so you're immediately ready to copy them all to the other destination. If your copying needs are simpler than that, you can, of course, use F5 as a Mark All function to copy all files of a directory.

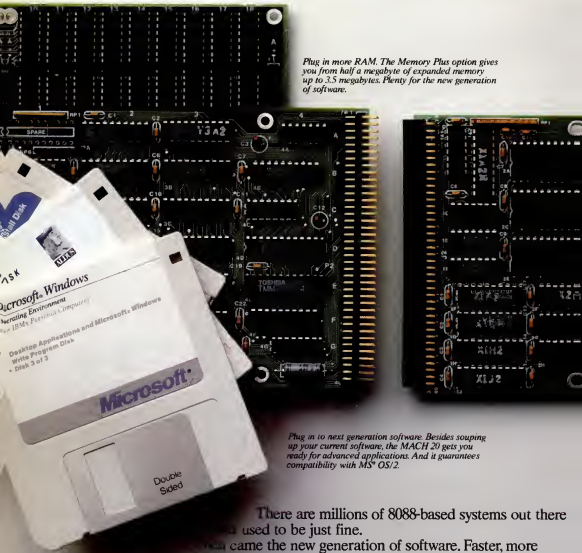
F6 (Verify) is an on/off toggle that performs the same as the /V switch in the DOS COPY command. Contrary to many users' expectations, DOS itself does not do a byte-by-byte comparison to check the accuracy of the data. All that Verify does is check whether the file can be read without error after writing. As with the DOS COPY command, the Verify switch defaults to off, as rereading the data obviously takes longer. The function was provided for those who sleep better with /V.

F2 initiates CO's second main function, Delete. As with copy, you can highlight and delete an individual file or a group of marked files. Before a file is consigned to oblivion, CO displays a verification warning, giving you a chance to abort. To continue with the deletion, press Y. An N or Esc response will spare the file till another day. As a file is successfully deleted, CO tidies up by removing its name from the listing, decrementing the indicated file count, and adjusting the bytes-free total.

That brings us to F3, Move a file to another directory. This function is extremely useful if you use one directory as a dumping ground for files that you want to file in appropriate cubbyholes later. The F3 Move function operates in the same manner as F1 Copy, prompting you for the new home of a highlighted file or a group of

(continues)

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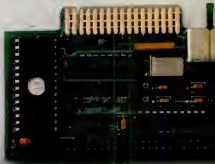
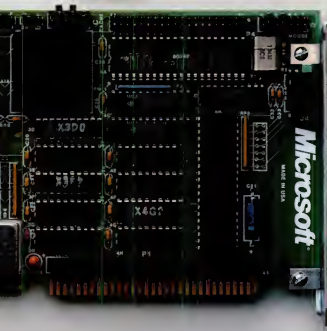
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(C'D) ASM continues.

■ UTILITIES

```

MOV SI,OFFSET DELETE_MSG ;display "will be deleted".
CALL GET_TEXT
MOV DX,1234h ;display warning message.
CALL DISPLAY_TEXT

=====
QUEST: CALL READ_KEY ;get a keystroke.
      CMP AL,10h ;is it "n"?
      JZ DELETE_END ;if yes, exit delete.
      CMP AH,1 ;is it Esc?
      JZ DELETE_END ;if yes, exit delete.
      CMP AH,10h ;is it "Y"?
      JZ DELETE_FILE ;if yes, delete
      CALL BEEP ;time, beep.
      JMP SHORT QUEST ;and get another keystroke.

DELETE_FILE: MOV DELETE_FLAG,1 ;indicate deletion.
             CALL EXEC_MAKED ;execute the command.
             MOV DELETE_FLAG,0 ;restore deletion flag.
             RET

DELETE_END: CALL CLEAR_MSG
             RET

=====
; This subroutine moves either the highlighted or marked file.
;
=====
MOVE: CALL COUNT_MARKS ;get count of marked files.
      CMP CX,0 ;any files marked?
      JNE MOVE_DONE ;if yes, display message.
      CALL GET_DISK ;file, use if highlighted in a
      JC MOVE_ERROR ;directory; if yes, exit.
      MOV DEST,0
      MOV SI,OFFSET MOVE_MSG ;display move message.
      CALL DISPLAY_TEXT
      JC MOVE_ERROR
      CALL DESTINATION ;get disk response.
      JC END_MOVE ;if Esc pressed, exit.
      MOV AL,CURRENT_DISK ;file, check if move across drive.
      AND AL,0x0F ;not default drive.
      CMP STX PTR ENTRY + 1,1 ;is there a drive specified?
      JNE CL_DRIVE ;if not, use default.
      MOV AL,ENTRY ;file, use user drive.
      AND AL,0Fh
      CMP AL,SOURCE ;is it the same as source?
      JZ JUST_RENAME ;yes, rename.
      JNE CL_DRIVE ;time, indicate both copy/delete.
      MOV COPY_FLAG,1
      MOV DELETE_FLAG,1
      MOV RENAME_FLAG,1
      CALL EXEC_MAKED ;execute the command.
      MOV DELETE_FLAG,0 ;restore all flags.
      MOV COPY_FLAG,0
      MOV RENAME_FLAG,0
      END_MOVE: RET

MOVE_ERROR: CALL BEEP
             RET

=====
; This subroutine clears all marks.
;
=====
CLEAR_MARK: MOV SI,OFFSET BUFFER ;point to start of listing.
            NEXT_CLEAR: MOV STX PTR [SI+1],0 ;write space over mark.
            ADD SI,FIELD_SIZE ;next record.
            CMP SI,END_OFFSET ;end of listing?
            JZ NEXT_CLEAR ;if no, continue until done.

=====
; This subroutine marks all files that aren't marked with an asterisk.
;
=====
MARK_BLANK: MOV SI,OFFSET BUFFER ;point to start of listing.
            NEXT_MARK: MOV STX PTR [SI+1],0 ;is it a directory?
            JZ LOOP_MARK ;if yes, skip.
            CMP STX PTR [SI+8],0 ;is it a hidden file?
            JZ LOOP_MARK ;if yes, skip.
            MOV STX PTR [SI],0 ;if no, skip.
            JZ LOOP_MARK ;if no, skip.
            MOV STX PTR [SI],COPY_MARK ;file mark.
            ADD SI,END_OFFSET ;next record.
            CMP SI,END_OFFSET ;continue until done.
            JZ NEXT_MARK
            RET

=====
; This subroutine marks or unmarks the highlighted file.
;
=====
MARK: MOV DL,COPY_MARK ;right arrow character.
      JMP SHORT STORE_MARK

UNMARK: MOV DL,32 ;space character.

STORE_MARK: CALL GET_NAME ;get filename.
            MOV MARK_END ;if directory, skip.
            CMP STX PTR [SP+10],0 ;is it a hidden file?
            JZ MARK_END ;if yes, skip.
            MOV [SI-1],DL ;file store the character.
            CALL IN_ARROW ;and move down a row.
            RET

=====
; This subroutine toggles the copy verify state.
;
=====
VERIFY: MOV VERIFY_FLAG,1 ;toggle flag.

```

(CO.ASM continues)

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```

JS      $40, GLOBAL      ; file, done here.
CMP     0, R1             ; if zero,
JNE     LOOP_EXIT        ; no, store user character.
MOV     AL, $[0]         ; else, store source character.

LOOP_EXIT:
STORE   EPC              ;
LOOP    DO_EXTENSION     ; Do will throw extensioins there.

END_GLOBAL:
XOR     AL, AL           ; make it an ASCII'0.
STORE   EPC              ;
JMP     SHORT PARSE_SRC  ; done here.

CR_PATH:
MOV     SI, 0            ; Any characters after path
CMP     PC, FILENAME_END ; delimiters
JL      TRACE_FILENAME   ; if no, tack on source name.
MOV     DI, OFFSET ENTRY ; else, see if it's a directory.
CMB     CL, 08           ;
CALL    FIND_FIRST       ;
PUSH    RAX               ; if not found, done here.
CMP     $[0], R1         ; if not directory, done here.
JNE     PARSE_END        ;
JNE     DI, FILENAME_END ; else, tack on source filename.
MOV     AL, "\\"         ;
STORE   EPC              ;

TRACE_FILENAME:
MOV     SI, FILE_NAME    ; source filename.
MOV     RAX, 0           ;
REP     MOVSB            ;
PARSE_END:
RET

;-----
; This section does the reading and writing to disk. ;
;-----
READ_WRITE:
MOV     DI, OFFSET SOURCE ; Point to source file spec.
XOR     R0M, AL          ; open file for reading.
CALL    OPEN_FILE       ;
JNC     GOTO_HANDLE      ;
JMP     END_W           ; Unit if failed.
SAVE_HANDLE:
MOV     DI, READ_HANDLE, AX ; Save the handle.
CALL    PC, 0            ; Get source
MOV     SI, 0            ;
MOV     R0M, 0           ;
LOOPSB ;
XOR     RAX, AX          ;
MOV     MOV     SOURCE_ATTRIB, AX ; attribute
LOOPSB ;
MOV     MOV     SOURCE_TIME, AX ; time
LOOPSB ;
MOV     MOV     SOURCE_DATE, AX ; date
LOOPSB ;
MOV     MOV     SIZE_LEN, AX ; end size
LOOPSB ;
MOV     MOV     KIDS_LEN, AX ; end size.
MOV     DI, OFFSET TARGET ; Point to target filename.
CALL    FIND_FIRST      ; if does it exist?
JNC     CR_F_PATH       ; if yes, see if same as source.
CALL    GET_DISK        ; else, get disk free space.
JMP     SHORT CR_FREE   ; too see if enough room.

CR_F_PATH:
MOV     DI, $[0] + 149   ; Get attributes of target
XOR     R0M, 0           ;
MOV     RAX, EPC         ; and save.
CALL    PC, 0            ; Read free-only attribute.
CALL    MOV     DI, OFFSET SOURCE ; Now get source attribute.
CMB     CH, 0            ;
MOV     MOV     SOURCE_ATTRIB ; see if it has changed.
PUSH    RAX              ; save compare results.
MOV     DI, OFFSET TARGET ; restore target attribute.
CMB     CH, 0            ;
CALL    CMB             ;
PCPB ;
STC ;
JNE     CLOSURE_READ    ; Assume files are the same.
CALL    GET_DISK        ; if they are, exit.
XOR     AL, 0            ; else, get free disk space.
ADC     $[0], DI         ;
XCHG    AX, SI           ; Target size + disk free.
XCHG    SI, DI           ; total - source size.
JBE     R0, R1X         ; if negative, not enough room.
;-----
CREATE:
MOV     DI, OFFSET TARGET ; Create and truncate target fil
XOR     RAX, 0           ; to zero.
MOV     AX, 0            ;
INT     21               ;
JC     CLOSURE_READ     ;
MOV     WRITE_HANDLE, AX ; save handle.
MOV     AL, 0            ; Point to second 64K segment
XOR     AX, 0           ; for read/write buffer.
MOV     DI, 0            ;
XOR     R0M, 0           ;
END

COPY_READ:
MOV     AX, CR_READ_HANDLE ; Read/read back handle.
MOV     DI, 0            ;
REP     MOVSB            ;
JMP     AX, 0            ;
JNC     COPY_DONE       ; if done, exit.
CMP     AX, 0            ; if error, also done.
JZ     CHANGE_SIZE      ;
MOV     RAX, 0           ; save bytes read.
MOV     CR, AX           ; store read into error.

```


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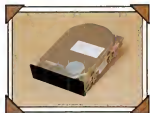
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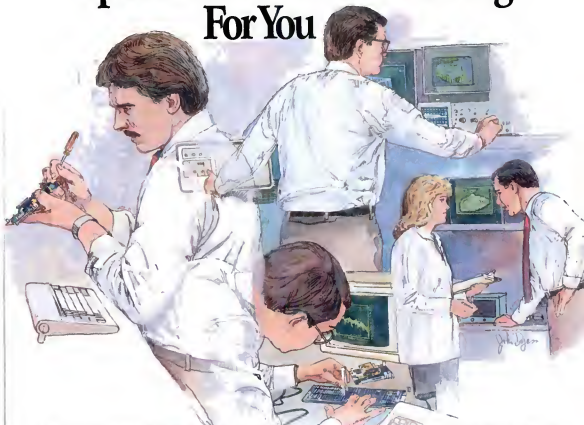
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■ UTILITIES

[illegible]

(CO-ASM continues)

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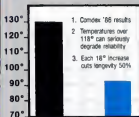


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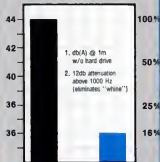
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■ UTILITIES

(IGD, ASM continued)

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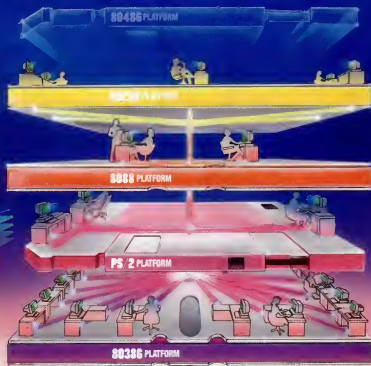
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■ UTILITIES

```

END_1100: CALL CLEAR_MDS ;Clear disk error message.
          POP  ES ;Restore registers.
          POP  DS
          POP  BP
          POP  DI
          POP  SI
          POP  DE
          POP  CB
          POP  BX
          POP  AX
          PUSHF
          MOV  AL,1 ;Return with carry removed.

```

```

                JST      R
CURRENT_DIR    EQU     CURRENT_DIR+4
WORKING_DIR    EQU     WORKING_DIR+4
PINGER_DIR     EQU     PINGER_DIR+4
SOURCE         EQU     SOURCE+4
TARGET         EQU     TARGET+4
ENTRY         EQU     ENTRY+4
BUFFER         EQU     BUFFER+4

CODE ENDG
END START

```

(CO_ASM_end)

marked files. If it is able to, CO will move the file or files to the destination directory that you indicate. Confirmation of a successful move is exactly the same as when you delete a file; the name will be removed from the directory listing. CO moves files across drives by first copying them as if you had pressed F1 and then, if successful, deleting them from the source directory as if you had pressed F2.

RENAMING IS EASY You can rename a file in the process of moving by simply tacking on the new name to the end of the destination path. If the source and destination are in the same drive, renaming is actually done by changing the directory entry on disk. Since this leaves the actual physical data alone, it's very fast and easy. Also, it enables you to move files around on a full disk. You can trick CO into renaming a file and leaving it in the current directory by telling it to move the file to the source directory with the new name. CO may appear confused, since it will remove the old name from the listing without replacing it with the new. Your file, however, will be intact.

CO observes all the DOS file-handling rules. You can't mark, copy, move, or delete hidden files or directories, and you can't delete read-only files. You can't copy a file over itself or over a read-only file. And you can't move a file to a directory that has a file of the same name. You probably won't want to use CO to copy files between the two logical drives A: and B: if you have only one physical floppy drive. (The constant swapping of source and target diskettes will drive you up the wall.) In this case, it's suggested that you either use DISKCOPY or copy all of the target floppy files to a temporary directory on C:, and then use CO to selectively copy back to the target diskette placed in A:

The last four CO functions control the different ways you can Sort the directory listing. These functions are F7 (Sort by

Name), F8 (Sort by Extension), F9 (Sort by Size), and F10 (Sort by DaTe). Unlike the DOS SORT.COM, the Date sort correctly handles the old problem of sorting by year as well as by month, date, and finally time. You might use F8, Sort by Extension, for example, if you were just interested in your .BAK files. The Sort functions can be used in combo with other

■ *WordStar* users will appreciate the fact that they can execute CO's functions with Ctrl-letter combinations.

functions. For example, if you want to see the latest file updates, press F10, Sort by DaTe, and immediately press End to take you to the end of the listing. Or if you want to see all your .COM files sorted by size, press F9, Sort by Size, and then F8, Sort by Extension.

Although the option is not spelled out on the menu, *WordStar* users will appreciate the fact that they can execute CO's functions with Ctrl-*letter* combinations. Thus, you can press Ctrl-C (also written ^C) for Copy, ^D to Delete, ^M to Move, ^V to toggle the Verify flag, ^N to sort by Name, ^E to sort by Extension, ^S to sort by Size, and ^T to sort by daTe.

In response to requests from DR users, I've made three additions to the CO directory listings. First, subdirectories are now listed and are identified with the same <DIR> signature in the size field as in a DIR listing. (You can't perform any functions on directories with CO, however; their inclusion is only for reference.) Second, to the right of the directory listing

you'll find the letter(s) H, S, R, or A next to any files that have a hidden, system, read-only, or archive file attribute. And third, I've included a line containing the number of bytes free on disk.

UNDERSTANDING CO When you tackle the DOS COPY command at the programming level, the subtle niceties it already provides quickly become programming nightmares. The tedious task of parsing a command line is a breeze compared with parsing all the legal combinations of a target copy parameter. There are three distinct ways to enter a target—path only, drive only, or filename only. You can then combine these in many different ways—for example, drive + path, drive + filename, or path + filename. And, of course, there are the global characters * and * to be dealt with, not to mention the mysterious dot dot directory path. DOS will not issue filehandles for files with ASCII names containing wildcards. It's up to the application to make the appropriate substitutions for the global characters. Also, unfortunately, there is no INT 21h function call to handle copying. The task must be broken up into reads (3Fh) and writes (40h).

CO tackles the destination parsing job by first checking to see if the user entered anything beyond a bare carriage return. If the target name is missing, CO knows that the target name will be the same as the source and lets DOS use the default drive and directory as the path when creating the file. If an entry is present, the fun begins with examining the entry starting from the end (it's marked by a zero) to the beginning, looking for one of the path delimiters, \ or . If one is found, CO forgets for the moment about everything to the left (the assumption is that such characters will be a path) and begins to parse everything to the right as a possible filename.

CO checks for any wildcard characters, ? or *, with the help of DOS function call

■ UTILITIES

```

100 REM --- BASIC PROGRAM TO CREATE CO.COM
110 OPEN "CO.COM" AS #1 LEN = 1
120 FIELD #1, 1 AM AS
130 CHECKSUM = 0
140 FOR I = 1 TO 499
150 LINENUM = I
160 IF I = 1 THEN
170 REM BYTES
180 CHECKSUM = CHECKSUM + BYTES
190 LINENUM = LINENUM + BYTES
200 IF (BYTES < 254) THEN LET AM = CHR$(BYTES)
210 PUT #1
220 NEXT I
230 READ LINENUM
240 IF LINENUM < LINENUM THEN PRINT "Error in Line" / 240 + I + 1
250 NEXT I
260 CLOSURE
270 IF CHECKSUM = 49535 THEN PRINT "Successful Completion" + END
280 PRINT "CO.COM file is not valid!" + END
290 DATA 223, 165, 3, 180, 67, 79, 32, 49, 658
300 DATA 48, 48, 32, 48, 67, 41, 32, 49, 255
310 DATA 57, 46, 55, 32, 98, 165, 162, 559
320 DATA 87, 111, 149, 189, 117, 158, 165, 748
330 DATA 99, 97, 114, 165, 111, 118, 115, 32, 785
340 DATA 67, 111, 46, 113, 18, 29, 77, 165, 455
350 DATA 95, 166, 97, 181, 109, 32, 74, 46, 643
360 DATA 32, 77, 181, 182, 182, 111, 114, 160, 739
370 DATA 8, 8, 8, 174, 7, 112, 112, 467
380 DATA 8, 8, 8, 8, 8, 12, 12, 12
390 DATA 8, 8, 3, 8, 13, 8, 8, 33
400 DATA 8, 29, 8, 8, 29, 8, 32, 18, 40
410 DATA 8, 8, 8, 8, 8, 11, 32, 11
420 DATA 8, 8, 67, 1, 8, 8, 8, 8, 40
430 DATA 8, 8, 8, 8, 8, 8, 8, 8, 8
440 DATA 8, 8, 8, 8, 8, 8, 8, 8, 8
450 DATA 8, 8, 8, 8, 8, 8, 8, 8, 8
460 DATA 8, 1, 99, 86, 61, 62, 63, 64, 378
470 DATA 74, 78, 31, 32, 46, 54, 245, 68
480 DATA 49, 58, 45, 46, 47, 48, 31, 72, 588
490 DATA 73, 79, 88, 81, 119, 132, 41, 4, 418
500 DATA 235, 8, 112, 215, 8, 8, 298
510 DATA 227, 7, 28, 8, 8, 8, 8, 298
520 DATA 8, 11, 16, 11, 8, 11, 25, 7, 89
530 DATA 236, 8, 11, 16, 11, 11, 16, 11, 315
540 DATA 248, 10, 8, 11, 8, 11, 16, 11, 315
550 DATA 222, 11, 114, 11, 209, 11, 239, 11, 991
560 DATA 119, 11, 114, 11, 239, 11, 239, 11, 991
570 DATA 82, 161, 132, 113, 165, 114, 181, 115, 840
580 DATA 32, 48, 98, 99, 79, 32, 162, 114, 510
590 DATA 180, 11, 32, 82, 99, 79, 32, 162, 114, 510
600 DATA 118, 118, 97, 168, 185, 168, 32, 168, 779
610 DATA 145, 114, 181, 99, 116, 111, 114, 121, 881
620 DATA 39, 46, 111, 111, 32, 169, 97, 110, 984
630 DATA 111, 32, 182, 195, 188, 181, 115, 36, 718
640 DATA 79, 111, 97, 168, 185, 168, 103, 32, 734
650 DATA 97, 118, 169, 32, 83, 111, 114, 119, 743
660 DATA 185, 118, 169, 32, 83, 111, 114, 119, 743
670 DATA 99, 116, 111, 114, 121, 46, 8, 78, 683
680 DATA 111, 97, 168, 185, 168, 103, 32, 168, 758
690 DATA 145, 181, 99, 116, 111, 114, 121, 46, 801
700 DATA 88, 8, 98, 165, 114, 181, 99, 114, 490
710 DATA 111, 114, 121, 32, 111, 162, 32, 8, 923
720 DATA 32, 32, 32, 78, 185, 188, 181, 512
730 DATA 49, 115, 41, 32, 32, 32, 32, 32, 354
740 DATA 32, 32, 32, 32, 32, 32, 98, 121, 41
750 DATA 114, 115, 32, 182, 114, 181, 181, 782, 13
760 DATA 8, 32, 119, 165, 168, 168, 32, 962
770 DATA 181, 32, 168, 181, 168, 181, 114, 181, 748
780 DATA 188, 8, 114, 181, 168, 181, 114, 181, 748
790 DATA 117, 32, 119, 165, 115, 144, 32, 119, 748
800 DATA 111, 32, 168, 181, 168, 181, 114, 181, 748
810 DATA 63, 32, 8, 32, 8, 114, 114, 114, 542
820 DATA 32, 114, 181, 97, 168, 185, 168, 183, 792
830 DATA 188, 114, 181, 97, 181, 32, 8, 349
840 DATA 48, 62, 41, 181, 116, 114, 121, 32, 647
850 DATA 111, 114, 32, 48, 95, 41, 117, 185, 181
860 DATA 117, 117, 32, 88, 97, 32, 121, 114, 478
870 DATA 188, 32, 182, 185, 168, 181, 115, 8, 993
880 DATA 97, 111, 112, 121, 32, 8, 77, 113, 413
890 DATA 118, 118, 32, 8, 78, 114, 111, 413
900 DATA 48, 46, 8, 42, 49, 42, 8, 32, 254
910 DATA 78, 78, 8, 79, 78, 78, 8, 98, 439
920 DATA 8, 13, 82, 82, 281, 285, 287, 168, 168
930 DATA 285, 285, 285, 285, 285, 285, 285, 1448
940 DATA 285, 285, 285, 285, 285, 285, 285, 1448
950 DATA 187, 189, 32, 187, 32, 187, 32, 187, 32
960 DATA 97, 183, 97, 123, 185, 181, 181, 32, 767
970 DATA 67, 79, 46, 97, 78, 77, 32, 169, 413
980 DATA 189, 48, 97, 114, 111, 114, 111, 48, 558
990 DATA 112, 114, 46, 97, 54, 55, 521
1000 DATA 32, 98, 32, 32, 109, 189, 32, 658
1010 DATA 112, 97, 72, 97, 184, 97, 72, 97, 72
1020 DATA 49, 32, 77, 181, 182, 182, 111, 945
1030 DATA 114, 168, 32, 189, 189, 166, 166, 114, 168
1040 DATA 186, 186, 189, 189, 189, 189, 189, 189
1050 DATA 189, 189, 189, 189, 189, 189, 189, 189
1060 DATA 189, 189, 32, 78, 49, 32, 32, 539
1070 DATA 32, 87, 111, 112, 121, 32, 32, 32, 539

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1080 DATA 32, 32, 32, 32, 32, 32, 32, 146, 418
1090 DATA 166, 32, 78, 58, 32, 22, 32, 48, 582
1100 DATA 181, 188, 181, 116, 181, 22, 32, 32, 423
1110 DATA 32, 32, 32, 32, 32, 32, 32, 32, 423
1120 DATA 78, 51, 32, 32, 22, 77, 111, 118, 523
1130 DATA 161, 32, 32, 32, 32, 32, 32, 32, 225
1140 DATA 32, 32, 166, 32, 32, 32, 32, 32, 423
1150 DATA 32, 32, 32, 67, 168, 181, 97, 114, 583
1160 DATA 32, 189, 97, 114, 187, 115, 32, 32, 638
1170 DATA 32, 166, 184, 32, 78, 53, 32, 423
1180 DATA 32, 77, 97, 114, 187, 32, 98, 645
1190 DATA 97, 119, 187, 32, 32, 32, 32, 164, 628
1200 DATA 186, 32, 78, 14, 32, 32, 32, 46, 524
1210 DATA 181, 114, 185, 182, 121, 32, 32, 32, 638
1220 DATA 78, 78, 32, 32, 32, 186, 186, 32, 687
1230 DATA 78, 55, 32, 32, 32, 83, 111, 114, 528
1240 DATA 114, 32, 98, 121, 32, 78, 97, 188, 482
1250 DATA 181, 32, 186, 186, 32, 78, 56, 495
1260 DATA 32, 32, 83, 111, 114, 119, 32, 98, 121, 787
1270 DATA 32, 185, 122, 184, 32, 32, 186, 493
1280 DATA 32, 189, 186, 32, 78, 57, 32, 32, 627
1290 DATA 32, 83, 111, 114, 119, 32, 98, 121, 787
1300 DATA 32, 78, 49, 48, 32, 32, 32, 32, 532
1310 DATA 114, 119, 32, 98, 121, 32, 46, 592
1320 DATA 87, 84, 121, 32, 32, 166, 186, 32, 758
1330 DATA 83, 47, 45, 32, 32, 77, 97, 114, 487
1340 DATA 187, 47, 85, 118, 189, 97, 114, 187, 776
1350 DATA 32, 186, 32, 186, 32, 98, 68, 120, 611
1360 DATA 98, 32, 118, 111, 32, 68, 120, 611
1370 DATA 185, 116, 32, 32, 32, 32, 32, 32, 413
1380 DATA 248, 248, 248, 248, 248, 248, 248, 248, 1448
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1930 DATA 248, 248, 248, 248, 248, 248, 248, 248, 1448
1940 DATA 248, 248, 248, 248, 248, 248, 248, 248, 1448
1950 DATA 248, 248, 248, 248, 248, 248, 248, 248, 1448
1960 DATA 248, 248, 248, 248, 248, 248, 248, 248, 1448
1970 DATA 248, 248, 248, 248, 248, 248, 248, 248, 1448
1980 DATA 248, 248, 248, 248, 248, 248, 248, 248, 1448
1990 DATA 248, 248, 248, 248, 248, 248, 248, 248, 1448
2000 DATA 248, 248, 248, 248, 248, 248, 248, 248, 1448

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(continued)

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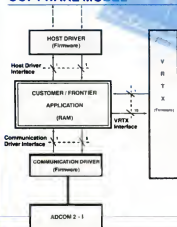
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■ UTILITIES

4866 DATA	129,	255,	252,	17,	116,	19,	79,	199,	1056	4468 DATA	54,	94,	1,	191,	64,	1,	103,	21,	699
4870 DATA	5,	8,	199,	167,	2,	232,	132,	1,	738	4470 DATA	109,	64,	8,	172,	138,	216,	232,	10,	997
4880 DATA	195,	139,	62,	16,	1,	79,	139,	247,	958	4480 DATA	8,	238,	248,	121,	199,	73,	254,	247,	1237
4890 DATA	131,	198,	44,	185,	22,	8,	243,	165,	988	4490 DATA	117,	238,	195,	139,	22,	65,	1,	161,	938
4898 DATA	59,	62,	98,	1,	116,	245,	131,	239,	949	4500 DATA	67,	1,	142,	192,	236,	148,	1,	117,	924
4110 DATA	44,	197,	62,	86,	1,	51,	237,	232,	862	4510 DATA	251,	258,	236,	168,	1,	114,	251,	138,	1431
4120 DATA	158,	8,	255,	14,	182,	1,	259,	14,	791	4520 DATA	195,	178,	251,	71,	14,	7,	195,	185,	1888
4130 DATA	104,	1,	117,	3,	232,	24,	249,	131,	872	4530 DATA	64,	23,	186,	79,	24,	235,	5,	51,	847
4140 DATA	62,	182,	1,	21,	135,	23,	129,	46,	469	4540 DATA	281,	184,	79,	28,	95,	83,	138,	62,	858
4150 DATA	108,	1,	168,	8,	139,	54,	188,	1,	555	4550 DATA	49,	1,	184,	8,	4,	285,	36,	91,	572
4160 DATA	129,	238,	168,	8,	59,	54,	186,	1,	747	4560 DATA	93,	195,	232,	133,	8,	172,	68,	8,	895
4170 DATA	119,	3,	232,	192,	8,	195,	191,	88,	1838	4570 DATA	116,	5,	232,	3,	8,	235,	246,	195,	1832
4180 DATA	2,	164,	32,	32,	171,	161,	184,	1,	487	4580 DATA	86,	188,	14,	285,	16,	94,	195,	188,	878
4190 DATA	51,	218,	232,	18,	8,	108,	6,	24,	719	4590 DATA	25,	285,	33,	195,	188,	14,	285,	33,	898
4200 DATA	199,	88,	2,	232,	28,	1,	195,	146,	882	4600 DATA	195,	188,	61,	285,	33,	195,	188,	62,	1111
4210 DATA	187,	10,	8,	252,	139,	282,	51,	218,	1852	4610 DATA	285,	33,	195,	188,	78,	285,	33,	195,	1124
4220 DATA	247,	243,	145,	247,	243,	144,	4,	48,	1323	4620 DATA	104,	1,	67,	285,	33,	195,	188,	8,	869
4230 DATA	178,	139,	192,	13,	282,	117,	237,	252,	1321	4630 DATA	67,	285,	33,	195,	139,	242,	178,	255,	1314
4240 DATA	195,	232,	235,	8,	198,	4,	3,	191,	1858	4640 DATA	128,	124,	1,	58,	117,	8,	138,	28,	564
4250 DATA	162,	1,	189,	28,	189,	22,	8,	172,	745	4650 DATA	128,	238,	95,	128,	238,	65,	232,	10,	1126
4260 DATA	138,	216,	232,	82,	8,	234,	246,	131,	1373	4660 DATA	8,	195,	138,	22,	38,	17,	128,	234,	764
4270 DATA	199,	116,	254,	287,	117,	238,	148,	4,	1301	4670 DATA	65,	232,	7,	8,	191,	148,	5,	232,	837
4280 DATA	8,	198,	74,	2,	232,	219,	8,	188,	907	4680 DATA	133,	254,	195,	254,	194,	188,	54,	285,	1469
4290 DATA	38,	17,	232,	218,	8,	232,	158,	255,	1148	4690 DATA	33,	51,	218,	247,	227,	247,	225,	195,	1435
4300 DATA	138,	36,	78,	1,	232,	185,	8,	195,	771	4700 DATA	187,	18,	8,	51,	281,	51,	218,	247,	957
4310 DATA	139,	54,	94,	1,	3,	245,	128,	254,	919	4710 DATA	243,	128,	194,	48,	82,	65,	83,	8,	821
4320 DATA	32,	18,	115,	8,	189,	6,	94,	1,	473	4720 DATA	8,	117,	242,	88,	232,	137,	255,	226,	1297
4330 DATA	32,	18,	235,	32,	139,	38,	98,	1,	545	4730 DATA	256,	195,	84,	58,	255,	148,	2,	285,	1223
4340 DATA	129,	251,	188,	21,	159,	8,	199,	6,	921	4740 DATA	16,	94,	195,	198,	4,	92,	79,	58,	719
4350 DATA	94,	1,	32,	18,	235,	14,	129,	215,	758	4750 DATA	218,	188,	71,	285,	33,	195,	178,	7,	1879
4360 DATA	156,	3,	98,	243,	218,	2,	139,	283,	963	4760 DATA	188,	2,	285,	33,	195,	188,	6,	285,	1888
4370 DATA	137,	54,	94,	1,	195,	139,	54,	188,	788	4770 DATA	22,	195,	188,	1,	285,	22,	195,	232,	1852
4380 DATA	1,	3,	245,	189,	212,	255,	129,	254,	1388	4780 DATA	248,	255,	116,	251,	232,	48,	255,	195,	1688
4390 DATA	87,	1,	114,	13,	189,	44,	8,	59,	487	4790 DATA	185,	8,	32,	235,	6,	139,	14,	72,	441
4400 DATA	54,	188,	1,	115,	4,	232,	5,	8,	511	4800 DATA	1,	188,	1,	285,	16,	195,	188,	59,	837
4410 DATA	195,	232,	172,	255,	195,	138,	38,	49,	1386	4810 DATA	285,	33,	195,	188,	48,	285,	33,	195,	1892
4420 DATA	1,	232,	12,	8,	137,	54,	186,	1,	543	4820 DATA	198,	258,	8,	185,	12,	8,	128,	48,	733
4430 DATA	138,	28,	71,	1,	232,	1,	8,	195,	648	4830 DATA	46,	117,	19,	128,	134,	1,	46,	117,	598
4440 DATA	138,	62,	186,	1,	185,	39,	8,	232,	764										
4450 DATA	33,	8,	238,	251,	195,	51,	237,	139,	1132										

(C/O BAS continues)

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4440 DATA	12,	255,	6,	182,	1,	172,	179,	176,	888	5878 DATA	194,	177,	5,	211,	289,	37,	42,	8,	887
4450 DATA	131,	199,	18,	235,	32,	185,	255,	6,	1844	5888 DATA	177,	8,	90,	181,	112,	131,	258,	12,	953
4460 DATA	182,	1,	172,	48,	8,	116,	18,	48,	538	5898 DATA	115,	2,	181,	87,	232,	46,	8,	138,	811
4470 DATA	46,	137,	12,	131,	232,	3,	176,	32,	758	5188 DATA	188,	148,	8,	176,	72,	246,	196,	2,	879
4480 DATA	243,	178,	131,	193,	3,	235,	235,	178,	1388	5118 DATA	137,	2,	176,	32,	178,	176,	83,	246,	1882
4490 DATA	226,	232,	174,	32,	243,	178,	87,	246,	1412	5130 DATA	194,	8,	117,	2,	176,	32,	178,	176,	873
4500 DATA	6,	149,	8,	16,	116,	11,	198,	255,	741	5138 DATA	92,	246,	196,	1,	117,	2,	176,	32,	852
4510 DATA	2,	71,	195,	5,	8,	243,	184,	235,	885	5144 DATA	178,	176,	65,	246,	196,	32,	117,	2,	1884
4520 DATA	17,	255,	6,	184,	1,	131,	199,	8,	721	5154 DATA	178,	32,	178,	71,	195,	179,	38,	246,	1878
4530 DATA	139,	22,	156,	8,	161,	154,	8,	232,	844	5168 DATA	243,	5,	48,	48,	128,	248,	8,	116,	837
4540 DATA	165,	253,	95,	131,	195,	11,	128,	32,	1831	5178 DATA	6,	48,	48,	157,	2,	176,	32,	171,	412
4550 DATA	152,	8,	139,	194,	177,	5,	213,	288,	1878	5188 DATA	138,	187,	178,	195,	251,	156,	48,	83,	1278
4560 DATA	27,	15,	8,	177,	255,	181,	45,	232,	942	5194 DATA	61,	82,	86,	87,	85,	38,	6,	88,	537
4570 DATA	147,	8,	139,	194,	37,	31,	8,	177,	725	5208 DATA	148,	288,	142,	216,	142,	192,	322,	288,	1484
4580 DATA	6,	181,	45,	232,	135,	8,	139,	194,	926	5218 DATA	253,	198,	175,	2,	146,	47,	23,	232,	1184
4590 DATA	177,	8,	213,	288,	37,	127,	8,	5,	766	5228 DATA	248,	253,	86,	6,	45,	232,	248,	253,	1183
5884 DATA	88,	8,	61,	188,	8,	214,	3,	65,	483	5238 DATA	188,	47,	24,	232,	238,	253,	332,	132,	1384
5810 DATA	188,	8,	177,	8,	181,	32,	232,	188,	839	5248 DATA	254,	128,	252,	19,	116,	8,	128,	252,	1157
5820 DATA	8,	71,	198,	22,	154,	8,	178,	194,	715	5258 DATA	116,	117,	243,	231,	143,	245,	232,	142,	1431
5830 DATA	177,	11,	213,	288,	37,	31,	8,	48,	747	5268 DATA	253,	5,	31,	93,	85,	94,	98,	89,	752
5840 DATA	61,	12,	8,	118,	3,	65,	12,	6,	251	5278 DATA	91,	80,	157,	176,	1,	287,	8,	8,	728
5850 DATA	61,	8,	8,	117,	3,	184,	12,	8,	337										
5864 DATA	177,	255,	181,	58,	232,	78,	8,	538,	1312										

(C/D BAS ends)

29h (Parse filename). This call was designed with the old FCB (file control blocks) in mind and makes conversion of the returned parsed filename into an ASCII string a little messy, but it sure beats expanding the wildcards by oneself. The call returns with AL = 1 if any wildcards are present, and it expands the asterisk into question marks. For example, *.BAK

would return ????????BAK. (Unfortunately, the all-important name-extension delimiter, the dot, was not used in FCBs, so we must supply it. Also, if a name is less than eight characters, the missing characters are replaced with spaces, an illegal character for filehandles, and these must be removed. This follows the same conventions used in disk directory entries.)

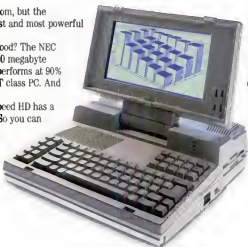
The question marks are carefully replaced with characters from the source name at matching character positions. If the source name is less than eight characters, the remaining question marks in the filename are ignored. The dot for the extension is added to the target name and then the extension is treated the same way, replacing any question marks with valid

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■ UTILITIES

source extension characters. Let's take the example of what would happen with

COPY MYFILE.1 TEMP.*

The parsed target returns from function 29h with TEMP_??? (where each of the four underscores represents a space character). CO starts constructing a filename at the end of the path marked by any \ or / found by the reverse searching technique discussed above. The name (the part before the dot) becomes TEMP, the end indicated by the spaces. CO adds the dot and sees that the extension for the parsed target has question marks. CO then substitutes for these, using any available source extension characters—in this example the solitary 1. Thus, the final interpreted target name becomes TEMP.1.

If that's not confusing enough, let me step back to the case where function 29h returns with AL = 0, indicating no wildcards are present. CO ignores the returned parsed name (remember, this is returned in old FCB format, sans dot, and we already have an entry in the desired ASCIIZ format). We still don't know if what's to the right of the delimiting path character is a filename or a directory. For example, if I entered

COPY MYFILE A:\ASM

you wouldn't know whether to make a copy to a file in the root of drive A: called ASM or to copy MYFILE to a directory called ASM. To solve the mystery, CO solicits the aid of DOS via the Find first matching file function (4Eh). That call returns with the attribute of the file in question (together with all the other information found in a file's directory entry). Let's suppose that function 4Eh tells us that ASM is a directory file. Remember, a directory is just a file with a directory attribute (10h). CO places a \ at the end of the path and tacks on the source filename. In this example, this would result in the target being A:\ASM\MYFILE.

Whew! I warned you it was a nightmare. Once the target is parsed, CO is *almost* ready to start the copy procedure. If a target file exists, CO must make sure the source and target are not the same file. To obey DOS's rules, CO uses a trick to see if

it is about to copy a file over itself. Logically, it might seem that the easiest way to see if source and destination are the same is to compare file specs. It turns out, however, that it's not very convenient to do a direct compare, thanks to all the possible combinations of entering a target parameter mentioned above. For example, A:\MYFILE and A:\MYFILE are the same file spec, assuming the default directory of A: is the root, but a string comparison would result in a mismatch. The same

■ To obey DOS's rules, CO uses a trick to see if it is about to copy a file over itself.

holds true if the source and target file specs are respectively C:\BIN\MYFILE and C:\MYFILE and the default directory of C: is BIN. The strings don't match but the file specs do. So instead of playing detective on file specs, CO tricks DOS into giving us the answer.

CO first retrieves the file attribute of the source file via the first-matching function (4Eh) and saves it. Then the target attribute is similarly retrieved and saved. The target attribute is then XORed with 1, which flips the first bit from what it was, and CHMOD, function 43h, is called and instructed to change the attribute of the target file. CO isn't really interested in what the attribute is—only in changing it. Next, the source attribute is sought again and checked against what was previously noted to see if it has been changed. If it's different, CO can deduce that the source and target are one and the same and can then refuse to carry out the illegal copy request. Of course, before all is done, the target attribute is returned to its original state.

If the target passes the check-if-not-same test, we're still not quite ready to copy. CO must see if there is enough disk space. Here two rules can be followed. If the target does not exist, i.e., there is a request to make a new file, all that CO needs to know is if the disk free space returned

from function 36h is equal to or greater than the size of the source file. The source size can be learned from our trusty find-first-matching function. If the target does exist, that is, CO is instructed to copy over an old file, then the target size plus the disk free space must be equal to or greater than the source size. This latter test frequently fails, for example, when an update file has grown considerably beyond the size of the outdated version it is to replace.

The actual reading and writing is a snap once all the parsing file name, check-if-same, and disk space checks are done. CO uses a whole 64K segment for a read and write buffer. When CO first starts up, it asks for two 64K segments' worth of elbow room to operate in. The first segment is used for the code, variable, and string storage and storage for the directory listing. The second segment serves as the read and write buffer for copying files. So large a buffer maximizes the efficiency and reduces the number of the read (3Fh) and write (40H) function calls. One 64K block is read and written at a time. Block reads and writes are continued until a read is less than the requested 64K, signaling that the end of file has been reached. One last thing must be done before the write file can be closed. The read file's time and date must be transferred to the write file. A copy means the file should have the date of the source as well. DOS function 57h (get/set a file's date and time) makes it simple to time/date stamp the file and complete the copy task.

If I haven't said much about moving files, it's because moving is simply the copying procedure described above followed by deletion of the source file. It's actually even simpler than that if the source and target are on the same drive. Then renaming the file is all that has to be done. Function 56h (Rename a file) does not require the directory paths to be the same, effectively moving a file to another directory in the renaming process. All that is changed is the directory entry; the data is untouched. The only rule that must be followed is that the target must not exist, a fact easily determined from the faithful old find-first matching function. The completion of the move, deletion of the source, is just as easily accomplished, using function 41h (Unlink).

CO BY MODEM

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If you use the Xmodem protocol, you can download CO.COM directly, saving typing or downloading either the .BAS or the .ASM version. CO.BAS, whether entered from the magazine at your keyboard or downloaded from PC-IRS, will automatically create CO.COM when run once in BASIC. CO.ASM, also listed both here and on PC-IRS, allows you to modify the program, but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM CO;
LINK CO;
EXE2BIN CO CO.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.



Michael J. Mefford

CO Command

1987/No. 21 (Utilities)

Purpose: Copies, moves, or deletes files individually or in tagged groups from directory listings sorted by name, extension, size, or date.

Format: `CO [d:][\directory][/E][/S][/D][/T][/O]`

Remarks: Entered without any of its optional parameters and switches, CO presents an alphabetized listing of the current directory with a menu of function-key commands on the right. The file attributes (Archive, Hidden, Read-Only, and System) are shown by the appropriate letters to the right of each listed file. The Up and Down Arrow keys move the file-selection highlight bar one line at a time. Ctrl-PgUp ('PgUp) and 'PgDn move to the top and bottom of the current display page (21 files), while PgUp and PgDn allow you to scroll through the entire directory listing. The Home and End keys go to the beginning and end of the listing, respectively. Pressing a letter moves the highlight bar to the first (then subsequent) filename(s) beginning with that letter. Multiple files are tagged for group copying, moving, or deleting by pressing the gray plus (+) key; the gray minus (-) key unmarks a mistagged file.

The optional /E, /S, /D, /T, and /O command-line switches sort the initial directory listing by Extension, Size, Date (/D) and /T operate identically), or Original DOS order. Once on screen, function keys F7 (Name), F8 (Extension), F9 (Size), and F10 (Date) can be used for subsequent sorts. F1 initiates the Copy process for the highlighted (or marked) file(s). F6 toggles the Copy Verify option (comparable to COPY /V). F2 and F3 are used for Move and Delete. You are prompted for the appropriate destination for Copy and Move: different drives and paths are supported, as is the use of the DOS ? and * wildcards. Renaming while copying is permitted.

When a marked (tagged) file is successfully copied, its marker arrow is replaced by an asterisk. If a floppy disk becomes filled, CO automatically attempts to find other marked files that will fit, but will then halt with some file(s) remaining to be copied. Replace the full diskette with another, hit F1 again, reenter the correct destination drive, and the remaining marked files will be copied.

To divide the contents of a directory into two parts, mark and copy the first set of files, as above, so that all have the "copied" asterisk. Then press F5 to mark the previously untagged files and repeat the copying process for the second group.

Note: CO functions can alternately be performed by Ctrl-letter commands: "C (Copy), "D (Delete), "M (Move), "V (Verify), "N (Name), "E (Extension), "S (Size), and "T (Date).

24-PIN

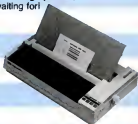
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CIRCLE 293 ON READER SERVICE CARD

PRODUCTIVITY

■ UTILITIES

ERROR HANDLING A critical error interrupt (24h) is generated if a read or write function is attempted on a disk when the disk door is left open. By default, DOS parks on this interrupt and is responsible for the "Not ready error reading drive A:" "Abort, Retry, Ignore?". You'll get a similar error if the disk is not formatted or is of the wrong density. Although the error handling is rather crude, it gets the job done. Further, it would seem reasonable, from the application point of view, to leave

■ When a critical error occurs within DOS, CO will be called for all the decisions of what to do, and it's really CO that asks you for direction.

the critical errors in the hands of DOS except for one small detail. An application has little control over where the message will be displayed.

It's desirable to have any disk problem messages appear in the reserved area in the lower right corner used for all of CO's prompts. The cursor can be positioned before any disk functions are called, and that guarantees where the first line of any such messages will appear. But the carriage return/line-feed automatically sends the second line (such as "Abort, Retry, Ignore?") to the beginning of the next line. In CO's case that would mean that the message would be indiscriminately written all over the directory listing. And multiple errors would send the listing scrolling off the screen. Uck!

The solution is for an application like CO to install its own critical error trap. (See Robert L. Hummel's discussion in PC Lab Notes, Volume 6 Number 19.) This is a simple matter of issuing function 25h (Set interrupt vector) with AL equal to 24h, the critical error interrupt. It's the same technique used to install any resident interrupt handler. Like all respectable in-

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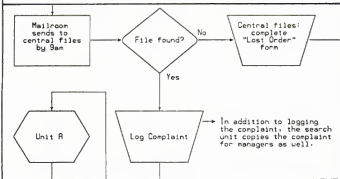
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■ UTILITIES

interrupt handlers, all that must be done by the interrupt handler is to issue an STI (enable interrupts) instruction and be sure to preserve any registers that are going to be used. The old (i.e., DOS's) vector need not be saved because DOS takes care of re-installing itself when the application exits.

Now, when a critical error occurs within DOS, CO will be called for all the decisions of what to do, and it's really CO that ends up asking you, the user, for direction. On entry to the handler, AH will have bit 7 set to 1 if it's a disk error (the most common occurrence). The second most likely problem is if the printer is not ready, indicated by a high bit of zero. CO has no printing functions, so on entry to the critical error routine, AH isn't even checked: a disk error is assumed.

CO doesn't improve much in the way the critical error is handled. The recovery option is either to (R)etry or (Q)uit, but at least the message is contained under the menu, in the proper prompt area. Retry issues an IRET with AL equal to 1, which requests DOS to retry the disk function. Quit is very similar to DOS's Abort except CO not only quits the disk function, but also returns you to the DOS prompt. Ignore is a dumb way to handle an error and is a sure-fire way to scramble a disk, so you won't find it in CO's vocabulary.

Specific information as to the type of disk error (drive not ready, seek error, or general failure, for example) can also be determined from the contents of the DI register, and it might be handled by a more sophisticated critical error handler. Particulars about the meaning of the register contents can be found in the DOS *Technical Reference* or in the Lab Notes article previously cited. CO's simple error handler serves its purpose, however, of taming the error messages.

So, if you have RN, the nurse, and DR, the doctor, all you have to do is add CO, the corporal, and you'll have a whole MASH unit that makes an unbeatable, complete file maintenance team. They come to my aid many times a day. I know I'd be lost without their support. And once you get to try them, I'm sure you'll wonder how you ever managed without them. ☐

Michael J. Mefford is a contributing editor of PC Magazine.

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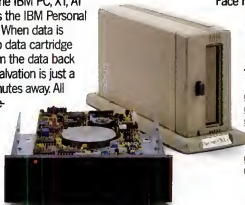
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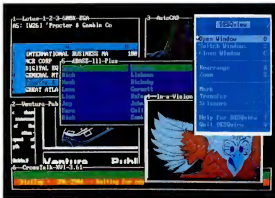
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UPWARD COMPATIBILITY THROUGH FAPI



While OS/2 is radically different from DOS, it incorporates several features that reduce the potential compatibility problems and ease the transition for developers.

As Henry Ford found, compatibility makes the world go 'round. So many different pieces of hardware and software go into a working computer system that they *must* function almost as interchangeable parts. Properly understood, compatibility involves the ability to upgrade parts of a system while still protecting past investments in applications programs, hardware peripherals, and user training. The PC standards that have developed over the years (starting with the IBM PC hardware, the PC BIOS, and MS-DOS) have provided a relatively solid platform upon which applications software has flourished. In this respect, compatibility equals stability.

But an obsession with compatibility becomes detrimental when it precludes change and creativity. The only way to achieve 100 percent compatibility is to be 100 percent identical. The more you try to improve something, the less compatible it becomes. The industry's answer to this problem is expressed in the idea of "upward compatibility." Something that is upward compatible incorporates the features of the old version (sometimes in an emulation mode) and then adds to it. This rarely works perfectly, but it usually works well enough.

Over the years we have thus experienced a generally smooth continuum of change—through various DOS versions, higher-resolution video boards, faster and more-efficient processors, and so forth—with relatively small bumps along the way. DOS 2.0 runs most DOS 1.1 programs; the EGA runs most CGA programs; the

80286 in real mode runs most 8086 programs. The bumps sometimes hurt (Lotus's 1-2-3 and the EGA, for instance), but they eventually get smoothed over.

So now comes OS/2—the biggest bump yet. OS/2 is a big improvement over DOS and consequently a big break from the DOS past. If you've been following this column over the past couple of months, you're now aware how different OS/2 is: OS/2 uses the protected mode of the 80286, and existing DOS programs can't run in protected mode. OS/2 uses a CALL-based applications program interface (API) rather than the software interrupts of DOS. DOS programs often directly access the hardware of the PC; OS/2 programs generally do not.

OS/2 would seemingly create compatibility problems never before experienced in the 6 years of the existence of the PC and DOS. Yet the extent to which OS/2 achieves compatibility with DOS is im-

pressive in many ways. Let's begin with the user's perspective.

THE USER'S VIEW OF OS/2 The command-line interface of the OS/2 Kernel is a familiar environment for DOS users. Most of the familiar DOS commands (DIR, COPY, CHKDSK, FORMAT, etc.) are duplicated in OS/2 and work essentially the same. The OS/2 command line feels a lot like DOS, except that OS/2 commands generally run somewhat faster than equivalent DOS commands. Likewise, the OS/2 Windows Presentation Manager will have the same user interface as *Windows 2.0* running under DOS.

OS/2 and DOS use the same file system. When the manufacturer of your favorite spreadsheet or word processor releases an OS/2 protected-mode upgrade, you will probably be able to use it with your existing files created under the DOS version. Upgrading a stock system from DOS to OS/2 should be relatively painless: people from Microsoft tell me that installation of retail versions of OS/2 on a hard disk will definitely not require reformatting. (This is not currently the case with the beta-level version of OS/2 available with the Microsoft OS/2 Software Development Kit.)

In fact, OS/2 is so compatible with DOS on the user's level that it is at first disappointing. Microsoft could have taken this opportunity to change the subdirectory separator from a backslash to a forward slash, for example. Or, much more importantly, they could have upgraded the file system to allow mass-storage devices to be

■ OS/2 would seemingly create compatibility problems never before experienced in the 6 years of the existence of the PC and DOS.

■ ENVIRONMENTS

larger than 32 megabytes or filenames longer than 11 characters. But they didn't. In this respect, desirable changes were sacrificed for compatibility.

THE DOS COMPATIBILITY BOX

The biggest concession to compatibility in OS/2 is the "DOS Compatibility Box." The Compatibility Box lets OS/2 run most existing DOS programs. In this sense, OS/2 is upward compatible with DOS. What OS/2 does not do is run existing DOS programs in protected mode, nor does it allow existing DOS programs to be multitasked.

The OS/2 Kernel divides a PC session into multiple "screen groups," each of which runs one or more programs that use the full screen. You can flip between screen groups from the keyboard. All but one of these screen groups run in protected mode.

The one screen group that doesn't run in protected mode is the DOS Compatibility Box. This screen group runs in real mode and mimics DOS 3.3. It provides no substantial functionality beyond DOS 3.3: you can't have more than one DOS Compatibility Box. Anything running in the DOS Box is temporarily suspended when you switch to a protected-mode screen group. There is no way to communicate between protected-mode programs and real-mode programs. You can't mix protected-mode programs and DOS programs in a DOS batch file or an OS/2 command file. There is no Compatibility Box version of the DETACH command to run a program in the background.

The DOS Compatibility Box is not perfect—indeed, it chokes on several existing programs. The programs that have the most problems in the Compatibility Box are those that rely upon undocumented DOS function calls or on specific internal locations within DOS. (*Microsoft Windows 1.0* is a notable offender in this respect.) Other problem programs are those that service hardware interrupts, such as communications programs. These programs are suspended when the Compatibility Box is not active and may lose input. OS/2 can also have problems in restoring the hardware state after a user switches away from and then switches back to the Compatibility Box. This will affect EGA

graphics programs, for example.

The DOS Compatibility Box is not a trivial part of OS/2. Its implementation requires that OS/2 be able to quickly switch between protected mode and real mode. Switching to protected mode is no problem, but the ability to switch back to real mode is not built into the 80286 chip. Because the Compatibility Box runs in real mode, it is as susceptible to crashes as DOS—perhaps even a little more so. But under OS/2, the real-mode crashes have worse consequences because multiple protected-mode programs may also be running.

Fortunately, you can eliminate the DOS Compatibility Box with a statement in your CONFIG.SYS file or—if you're not quite ready for that bold move yet—reduce the Compatibility Box to something less than 640K. OS/2 can use the excess memory for protected-mode programs.

The presence of the DOS Compatibility Box sometimes makes discussions of OS/2 a bit confusing. For the remainder of this column, when I say "OS/2," I'll really be talking about the OS/2 protected-mode environment. When I say "DOS," I mean DOS 2.x and 3.x as well as the OS/2 DOS Compatibility Box.

THE JOB FOR DEVELOPERS

The job of making existing programs run under OS/2 is left in the hands of the software developers themselves. This involves converting programs from the chaotic (and often nonexistent) DOS API to the OS/2 API. During the transition period, the DOS market will obviously continue to be very important. Does this mean that software developers must maintain two different sets of source code files and distribute two different executable files for the two environments?

Not necessarily. While programs written for DOS cannot run under OS/2 protected mode, programs written for OS/2 can—under some circumstances—run under DOS. Once programmers do the initial conversion to OS/2, it might be possible to permanently archive the real-mode version of the source code.

There are a couple ways to do this. They all revolve around something not quite obvious at first—the format of the executable file.

THE TWO .EXE FORMATS OS/2 executable files have an .EXE extension just like DOS executables. Yet the file format of an OS/2 executable is significantly different. Why would the two different file formats be given the same extension?

To begin answering this question, let's review what we know about the .EXE format under DOS. As shown in the diagram "DOS Header," a header section (docu-

DOS Header



The .EXE file recognized by DOS contains a header section with relocation information followed by the program itself.

mented in the *DOS Technical Reference* manuals and many other books) located at the beginning of the file contains mostly relocation information. DOS uses this to adjust segment references within the program when loading the program into memory. The header is followed by the code and data segments of the program.

OS/2 recognizes a different .EXE format that is called the New executable format. The New executable format begins with an old .EXE header. It then has a second header containing information that OS/2 needs to run the program. This is followed by the code and data segments of the program. Relocation information (including dynamic link information) follows each segment individually. A very simplified layout of the New executable format is shown in the diagram "OS/2 Header."

Under the New executable format, a double-word stored at 3Ch in the old .EXE header is an offset from the beginning of the file to the beginning of the new .EXE header. When OS/2 executes the program, it can use this stored value to simply ignore everything in the file up to the new .EXE header.

When you run an OS/2 program under DOS, DOS looks at the old header and rec-

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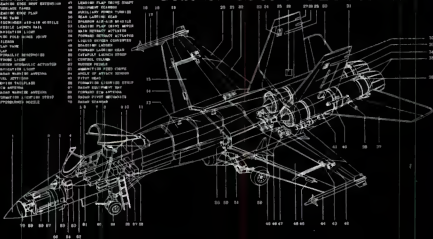
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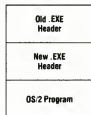
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OS/2 Header



The .EXE file recognized by OS 2 contains a DOS-style header section that OS 2 ignores, followed by a new format header and the program itself.

organizes the file as a legitimate .EXE file. But DOS will not be able to run the program. By default, the new LINK that constructs the OS/2 .EXE file happens to create an old .EXE header with an FFFFh at offset 0Ah. This indicates to DOS that the program requires a megabyte of memory to run. DOS displays the message "Program too big to fit in memory".

ONE .EXE, TWO PROGRAMS The use of the old .EXE header in the New executable file is intriguing. If the file includes an old .EXE header, the file might be able to accommodate a DOS program as well. It's not too difficult to imagine a file with an organization as shown in the diagram "Integrated Dual Program."

Such an .EXE file would contain two complete programs: one for the DOS API and the other for the OS/2 protected-mode API. DOS (and by extension the OS/2 Compatibility Box) would run the DOS version and OS/2 would run the OS/2 version.

Here's how you do it. When we wrote a few simple OS/2 programs in Environments a couple of issues ago, I indicated that the syntax of the LINK statement for a program with a single object module was

```
LINK MYPROG, /ALIGN:16, ,DOSCALLS;
```

where MYPROG is the name of the program you're linking and DOSCALLS.LIB is the name of the import library that re-

solves the OS/2 function calls.

The new LINK actually can accept five parameters, like this:

```
LINK MYPROG, /ALIGN:16, ,DOSCALLS, MYPROG
```

The last parameter is the optional name of a "module definition file" which customarily has the same name as your program and an extension of DEF.

The module definition file is an ASCII file. A very simple example of a DEF is shown below:

```
NAME          MYPROG
STUB          'MYOLDPRG.EXE'
DESCRIPTION   'Copyright Notice'
```

The module definition file very often also includes other information defining the characteristics of the code and data segments of the program. Once again, this aspect of OS/2 programming is old news to programmers of applications for *Microsoft Windows*. *Windows* programmers have been working with the New executable format and module definition files for 2 years now.

The filename that follows the STUB keyword in the module definition file is the name of a DOS program (here called MY-OLDPRG.EXE) that LINK inserts into the .EXE file, exactly as shown in "Integrated Dual Program." *Windows* programmers

generally use this technique with a standard DOS program that displays the text "This program requires *Microsoft Windows*" when you attempt to run the program under DOS. But the STUB program can be used in more-useful ways—one *Windows* utility I have changes file attributes from a dialog box when run under *Windows*. The STUB program is a simple DOS command-line attribute changer.

Putting two complete versions of a program into the same .EXE file really only makes sense for small programs or utilities. For a large program, the resultant .EXE file would be enormous. Moreover, much of the program might be the same in both versions. It's only when the program makes an operating system function call or (in the case of the DOS program) directly accesses the computer's hardware that the versions significantly differ.

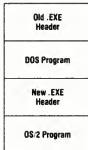
Might there be a better approach to DOS compatibility that would involve only the part of the program that makes operating system function calls? There is. Welcome to FAPI.

THE FAPI CONCEPT FAPI (it rhymes with happy) stands for Family API. FAPI involves developing a program for OS/2 protected mode using a subset of the OS/2 API, and then doing something to make the program also run under DOS or the DOS Compatibility Box.

An understanding of FAPI begins with the observation that many of the simpler OS/2 function calls have DOS equivalents. For example, if you want to write to a file or device in DOS, you use the interrupt 21h function call 40h. You tell DOS the file or device handle, the address of the buffer, and the number of bytes to write. DOS performs the operation and returns the number of bytes it actually wrote or an error code.

To write to a file or device under OS/2, you use the DOSWRITE call. It requires the same information as the DOS function call 40h and returns the same information. The only substantial difference is the manner in which you make the request of the operating system. OS/2 uses far calls with parameters passed on the stack, while DOS uses software interrupts with parameters passed through registers. OS/2 and DOS also use different error codes.

Integrated Dual Program



A New executable format file can contain two complete programs: one that runs under DOS and one that runs under OS 2.

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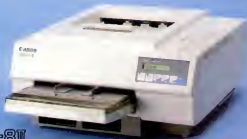
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The far calls that an OS/2 program makes to DOSWRITE and other OS/2 functions are dynamically linked with the operating system entry points when OS/2 loads the program into memory. But what if somehow these far calls were resolved instead to call functions that took the information passed on the stack, put it into registers, and called the equivalent interrupt 21h routines? These functions would effectively translate the OS/2 function calls into DOS function calls. This is precisely what is done.

THE MECHANICS OF FAPI Normally, when you create a program you go through two steps—a compile (or assemble) and a link. Creation of a FAPI application requires running a third step using a program included with Microsoft's OS/2 Software Development Kit, called BIND .EXE. This program requires a library file named API.LIB:

BIND MYPROG.EXE API.LIB

BIND alters MYPROG.EXE so that it can run under both protected mode and real mode.

(At least, that's the way BIND should work. The version supplied with the initial OS/2 Software Development Kit requires that API.LIB be prefaced with its directory path if it is not in the current subdirectory. BIND should be using the LIB environment string for this subdirectory. BIND also presently requires that the DOSCALLS.LIB import library be specified as another parameter. I'm sure that Microsoft will fix these problems when BIND is included in a lower-cost OS/2 Software Development Kit to be available next year.)

API.LIB is a normal object code library that contains a collection of functions. These functions have the same names as the OS/2 Kernel function calls, such as DOSWRITE, DOSEXIT, DOSBEEP, and VIOWRTTTY (to mention only the few I've discussed in previous columns). But the code for these functions makes DOS interrupt 21h calls (and in some cases directly accesses the PC's hardware) using the parameters to the function passed on the stack.

BIND determines from the relocation tables of the OS/2 .EXE file which OS/2

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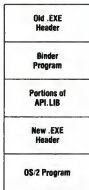
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function calls the program makes. It embeds these functions from API.LIB into the .EXE file. It also embeds a binder program that runs when you execute the .EXE file under real mode. A block diagram of the resultant .EXE file is shown in "A Dual-Mode .EXE Program."

A Dual-Mode .EXE Program



A FAPI application contains an OS/2 program and a binder program with library routines. This binder program modifies the OS/2 program so it can run under DOS.

When you run the program under OS/2, OS/2 ignores everything before the New .EXE header. When you run the program under DOS or the DOS Compatibility Box, the binder program runs first. It modifies the OS/2 program so that the far calls to the OS/2 functions actually go to the portions of API.LIB that translate these function calls into DOS equivalents. The binder program then sets up entry conditions to mimic the OS/2 environment and branches to the start of the program.

Many of the external command programs included with OS/2 (FORMAT, CHKDSK, and so forth) are actually FAPI applications. You don't get two versions of CHKDSK with OS/2. You get one dual-mode CHKDSK that runs in real and protected modes. The MASM.EXE macro assembler is a FAPI application, as are LINK.EXE and BIND.EXE.

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THE LIMITS OF FAPI FAPI is not an all-purpose problem solver. First, the functions that you can use with FAPI are only a subset of the OS/2 functions available in a non-FAPI OS/2 program. FAPI doesn't magically provide ways for a program running under DOS to use the multitasking or interprocess communication features of OS/2.

Some OS/2 functions that can be used in FAPI programs are restricted in use. You don't have the full range of options available under protected mode. The OS/2 `DOSEXECPGM` ("Execute Program") function, for example, executes another program as a child process. One of the parameters to `DOSEXECPGM` specifies whether the child process is to run "synchronously" or "asynchronously" with the parent. Running synchronously means that the parent process is suspended until the child process terminates. Running asynchronously means that the `DOSEXECPGM` function returns control to the parent after the child process is started up and the two programs run simultaneously. (This is how the OS/2 `DETACH` command works.)

You can use `DOSEXECPGM` to execute a child process synchronously in a FAPI program because that is equivalent to the DOS interrupt 21h function call 4Bh. But you can't asynchronously execute a child process under DOS because DOS can't run two programs simultaneously.

FAPI also considerably increases the size of the .EXE file. A month ago in this column I showed two simple programs. The `NOTHING.EXE` program was just 225 bytes for the OS/2 version, but it blows up to 5,553 bytes for the FAPI version. That increase is almost entirely overhead.

The assembly language version of `VICTORY.EXE` was 362 bytes long. After running `BIND`, it becomes 19,328 bytes. Why so large? Well, `VICTORY` used the OS/2 function call `VIOWRTTTY`. All the OS/2 VIO (video I/O) calls are translated by the `APL.LIB` library into direct accesses of the video hardware. The VIO functions are thus very fast under DOS, but using them involves more overhead because the library has to figure out what type of video adapter the machine has.

The `ENVIRON.EXE` file shown in the

last Environments column used `DOSWRITE` for writing to the display. `DOSWRITE` translates fairly easily into DOS function call 40h. The `ENVIRON.EXE` file increases in size from 393 to 5,753 bytes after running `BIND`, which is more in line with the `NOTHING.EXE` program. Obviously the increase for much larger .EXE files will be less shocking.

If you become convinced that the code in `APL.LIB` is not quite as tight as you'd like, you are not locked into using this particular library. You can try your hand at writing your own translation functions and use `BIND` with your own library. You can also use `BIND` with `APL.LIB` for most calls but with your own object modules for a selected few of the functions. If you figure out how to execute a child process asynchronously under DOS, you can rewrite the `DOSEXECPGM` function and use that instead of the one in `APL.LIB`.

You can also have separate processing logic in your program for real mode and protected mode. The `DOSGETMACHINEMODE` function returns a 1 under protected mode. The `APL.LIB` version of `DOSGETMACHINEMODE` returns a 0. A FAPI program can use this function call to execute different code depending on the environment.

OTHER TRICKS WITH APL.LIB Even if you have no intention of writing a program that runs in OS/2 protected mode, you can still use `APL.LIB` with your DOS programs. For example, you might fall in love with the collection of OS/2 character-mode video I/O functions (to be discussed in next issue's Environments column) and

want to use them in a DOS program.

You should keep in mind that `APL.LIB` is a normal object module library. You can call the functions in `APL.LIB` from a DOS program and then link the DOS program with the library. You'll be using the names and syntax of OS/2 functions, but the functions from `APL.LIB` will actually make DOS interrupt 21h function calls and (in the case of the video I/O calls) directly access the video hardware. The "Alternative Program Environments" table shows various alternatives involving the use of `APL.LIB`.

The first case is what you do normally under DOS; the second case creates a normal protected-mode program that cannot run under DOS. The third case is a program that uses the syntax of OS/2 function calls but runs under DOS. The fourth case is a dual-mode FAPI program. The new `LINK` determines whether to create an old format .EXE or new format .EXE depending upon the presence of far calls to dynamic link library modules.

THE FUTURE OF FAPI FAPI solves some immediate problems during the transition from DOS and OS/2 with a form of "backward compatibility" rather than the upward compatibility discussed earlier. FAPI allows OS/2 to be distributed with only a single set of external command programs (`CHKDSK`, `FORMAT`, etc.) rather than separate versions for protected mode and the DOS Compatibility Box. Other software manufacturers can do the same for their own programs. Many of the early public-domain OS/2 programs you'll see will probably also be FAPI programs.

Alternative Program Environments

Program Uses	LINK With	BIND With	.EXE Format	Runs Under	
				OS/2	DOS
Interrupt 21h	None	None	Old	No	Yes
OS/2 Functions	<code>OOCALLS.LIB</code>	None	New	Yes	No
OS/2 Functions (Interrupt 21h also allowed)	<code>APL.LIB</code>	None	Old	No	Yes
OS/2 Functions	<code>DOSCALLS.LIB</code>	<code>APL.LIB</code>	New	Yes	Yes

The way you `LINK` or `BIND` a program determines the environment in which it will run

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PRODUCTIVITY

■ ENVIRONMENTS

But FAPI is frustrating also because it illuminates the deficiencies of DOS. The really neat stuff in OS/2 is precisely the stuff you can't do under DOS. If you start with the goal of writing an OS/2 program that will be a FAPI application, you effectively limit yourself to writing a DOS-like program with an OS/2 API. It's just no fun. If you see a need to create a second thread of execution in the program, you can't do it if you want the program to run under DOS.

Once programmers get comfortable with OS/2, I suspect they will abandon FAPI in favor of exploiting the full resources of OS/2. The DOS versions of their applications will stop growing while the OS/2 versions take off.

THE PRESENTATION MANAGER

I've been discussing how FAPI works with the OS/2 Kernel. The OS/2 Windows Presentation Manager is a whole other story, however. There is no FAPI for the Presentation Manager.

This is a serious deficiency. Microsoft has been pushing *Windows* as a graphical environment for DOS and is now pushing Presentation Manager as the primary application environment of OS/2. The Presentation Manager was derived largely from *Microsoft Windows* so, in theory, there should be a way to allow Presentation Manager programs to run under the DOS version of *Windows*.

As of this writing, the Presentation Manager specification has recently been distributed to owners of the OS/2 Software Development Kit. (The OS/2 SDK now weighs in with 11 manuals, a big stack of diskettes, and two additional binders containing information discussed in a 3-day seminar. The \$3,000 cost of the kit is beginning to seem less unreasonable.)

Judging from this specification, the Presentation Manager API is based heavily on *Microsoft Windows*, but there have been substantial changes to the names and syntax of functions and data structures. The graphics interface of the Presentation Manager has been greatly changed and enhanced. But information on converting *Windows* programs to the Presentation Manager comes at the very end of the three volumes and 1,100 pages of specifications in a section entitled "Migration from Mi-

crosoft Windows." In summary it says: "Microsoft Windows Version 1 applications will have to be rewritten to run under the Presentation Manager."

There's a basic contradiction here. Microsoft is essentially telling us: "For simple character-mode programs, convert the programs from DOS to OS/2 and use FAPI to get backward compatibility with DOS." I like that approach because developers can begin programming for the future using the OS/2 API but need maintain only one set of source code files and .EXE files for both environments.

■ FAPI is frustrating because it illuminates the deficiencies of DOS. The really neat stuff in OS/2 is precisely the stuff you can't do under DOS. It's just no fun.

But for the Presentation Manager, the word from Microsoft apparently is: "Write programs for Windows now and we may provide some tools to help you convert them to the Presentation Manager later." This is not so good, because there is no promise yet of anything that will relieve developers of the burden of maintaining two sets of source code modules to create programs for both Windows and the OS/2 Presentation Manager.

Recently Microsoft has been asserting that the DOS version of Windows is still alive and kicking and very important to the future of DOS. If so, it becomes even more important for Microsoft to provide some kind of clean bridge between Windows and the Presentation Manager. A FAPI for the Presentation Manager is one way to do it. A Presentation Manager for DOS is an even better way.

Charles Petzold is a contributing editor of PC Magazine.

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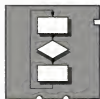


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BUILDING ON A SOUND STRUCTURE



By adopting the concepts of structured programming from the beginning, you'll develop the good programming habits you'll need as your programs become more sophisticated.

The assembly language programs published in popular books and magazines are often characterized by such poor programming ingredients as intermixed code and data; procedures that take several pages to list (or, even worse, a single mammoth procedure that comprises the entire program); jumps made in all directions from every point in the program to every other; and labels (symbolic names for program locations) seemingly picked at random. In other words, classic spaghetti code. Given such examples to examine, it's small wonder that assembly language has acquired a reputation for being difficult to code, read, and debug.

In these columns I'll try to offer you an alternative to such convoluted techniques. I want to present a more structured approach to assembly language programming, one that will aid you at every stage in program creation and maintenance. By "structured" I do not mean what in computer science courses is often called "GOTO-less" programming, for an assembly language program without any branches would be a useless beast at best. That much excepted, however, the academicians do have many worthwhile things to say about modularization, flow of control, and the naming of names that should be incorporated into your assembly language programming style.

Initially, you may have an instinctive reaction against an emphasis on structure and naming, dismissing them as superficial or cosmetic concerns. After all, once the program has been translated and linked, there is nothing but the cold, cold

bits to tell the machine what to do. The symbols so thoughtfully assigned back in the source code are nowhere to be seen, and what may seem an overconcern with the appearance of the source code may strike you as superstitious behavior, an appeal to magic.

A reasonable criticism, and one to which I respond (with tongue somewhat in cheek): exactly right. Computer programming is perhaps the only realm where magic, in the sense of bringing about a physical effect by the utterance of the right words in a certain order, is obviously the genuine article. [Other realms would involve things like judicial sentences, marriage vows, and the like.—Ed.] Just as the sorcerers of old felt some incantations superior to others, many computer scientists have become convinced that a systematic selection of names and structuring of source code yield tangible benefits in the design, testing, and maintenance of software. Fifteen

years of writing assembler code for a living has persuaded me that they know what they are talking about.

THE ELEMENTS OF STRUCTURE

Three structural levels are important in macro assembler (MASM) programming:

- the module level
- the segment level
- the procedure level

Modules are simply chunks of source code that can be independently maintained and assembled. Segments are physical groupings of like items (machine code or data) within a program, and correspondingly, a segregation of dissimilar items. Procedures are functional subdivisions of the executable program, i.e., routines that carry out a particular job.

THE MODULAR FACTOR Under MS-DOS, the module level of structure is represented by a file. Each MASM source file is translated by the Macro Assembler into a relocatable object module. An object module can reside in an individual (.OBJ) file, or many object modules can be indexed and stored together in a library (.LIB) file. The Linker combines one or more .OBJ files (sometimes with additional object modules extracted from libraries) into an executable program (.EXE) file.

When you're just getting started in MASM programming, the concept of modules will probably not have much immediate use. Each time you need a particular routine, you'll be writing and debugging it for the first time. Consequently,

■ Initially, you may have an instinctive reaction against an emphasis on structure and naming, dismissing them as superficial or cosmetic.

■ POWER PROGRAMMING

your early programs will typically consist of a single module, with all of the necessary procedures for its execution contained in one source code file.

As you log more hours in the MASM cockpit, however, you will find that you use many identical or virtually identical procedures over and over. You'll repeatedly need routines that convert an ASCII string to a binary number and vice versa, extract filenames or switches from the command tail, find a string in the environment block, and so on. You can extract these frequently used routines, make them into individual MASM source files, assemble them as separate modules, place the resulting .OBJ files in a library with the LIB utility, and then exploit the Linker's ability to extract them from the library when they are needed.

The use of such modules reduces the size of each of your application source files, since the latter do not need to contain the source code for subroutines that they have in common with other programs. It also allows you to maintain the subroutines more easily, since their source code is centralized instead of existing in many copies in different applications. Thus, when you improve (or fix) one of these routines, you can simply reassemble it, stuff the .OBJ file into the library, relink all of the programs that use that routine, and voilà! instant upgrades. The MAKE utility, which goes hand in hand with LIB and LINK, will assist you in automating this entire process.

We'll get into a more detailed consideration of modules, libraries, and the MAKE, Librarian, and Linker utilities in later columns. For now, it's enough to keep in mind the long-range goal of learning to exploit the module concept; it will vastly increase your productivity.

THE SEGMENT FACTOR The Intel 8086/88 and 80286 microprocessors have four segment registers. Each segment register provides access to a 64K area of memory. Thus, a program can address any location in memory by appropriate manipulation of the segment registers, but the maximum amount of memory that it can address simultaneously is 256K.

As you are undoubtedly aware, MS-DOS supports two types of executable pro-

gram files: .COM and .EXE. Programs of the .COM type, which are endorsed by MS-DOS for historical reasons, assume that all four segment registers always point to the same place—the bottom of the program—and thus are limited to a maximum of 64K in size. On the other hand, .EXE files can contain many different segments and allow the program to reset the segment registers to point to each segment as it is needed. Consequently, the only practical limit on the size of an .EXE program is the amount of available memory.

In the MASM source code for an .EXE program, segments are declared with the SEGMENT and ENDS directives in the following form:

```
name SEGMENT attributes
.
.
.
name ENDS
```

The attributes of a segment include its alignment type (byte, word, or paragraph), combine type (public, private, common, or stack), and class name. The segment attributes are used by the Linker when it is creating the executable program by collecting together segments of the same name or segments with different names but the same class names. Most of the time, you can get along perfectly well using only a small selection of attributes in a rather stereotyped way (which I'll demonstrate below). However, if you want to read more about them, a detailed explanation can be found in the MASM manual.

A minimum of three segments must be

declared in an .EXE program: a code segment, a data segment, and a stack segment. In cases where a program has more than 64K of code or data, the routines or data used most frequently are put into the primary code and data segments. This is done for reasons of speed. Routines and data structures that are not used frequently are put into secondary ("far") code and data segments. Programs are classified into one memory model or another by the number of their code and data segments. The most commonly used memory model for assembly language programs is the small model, which has one code and one data segment, but there are several others that may also be used, as shown in the table "Common Memory Model Terminology for Assembler and C Programs."

For each memory model, Microsoft has established certain segment and class names that are used by all its high level language compilers (see the table "Standard Memory Model Segments, Groups, and Classes"). Since segment names are arbitrary anyway, you may as well adopt these Microsoft conventions. Their use will make it easier for you to integrate your assembly language subroutines into programs written in languages such as C and to use routines from high-level language libraries in your assembly programs.

Another important Microsoft language convention is that the program's "near data" segment, or the segment that the program expects to address with offsets from the DS register, and its stack segment, should be named with the group directive as members of DGROUP. DGROUP is known as the "automatic

Common Memory Model Terminology for Assembler and C Programs

Model	Code Segments	Data Segments
Small	One	One
Medium	Multiple	One
Compact	One	Multiple
Large	Multiple	Multiple

Two additional models exist that we will not be concerning ourselves with further: the tiny model, which consists of intermixed code and data in a single segment (e.g., a .COM file under MS-DOS), and the huge model, which is supported by the Microsoft C Compiler and allows use of data structures larger than 64K bytes.



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■ POWER PROGRAMMING

Standard Memory Model Segments, Groups, and Classes

Memory Model	Segment Name	Align Type	Combine Class	Class Name	Group
Small	__TEXT	word	public	CODE	DGROUP DGROUP
	__DATA	word	public	DATA	
	STACK	para	stack	STACK	
Medium	module__TEXT	word	public	CODE	DGROUP DGROUP
	•				
	__DATA	word	public	DATA	
Compact	__TEXT	word	public	CODE	DGROUP DGROUP
	data	para	private	FAR__DATA	
	•				
Large	__DATA	word	public	DATA	DGROUP DGROUP
	STACK	para	stack	STACK	
	•				
	module__TEXT	word	public	CODE	DGROUP DGROUP
	•				
	data	para	private	FAR__DATA	
	•				DGROUP DGROUP
	__DATA	word	public	DATA	
	STACK	para	stack	STACK	

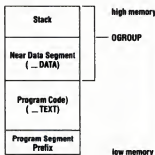
Segments, groups, and classes for the standard memory models as used with assembler language programs. Microsoft C and other high-level language compilers use a superset of these segments and classes.

data group" and has a special significance under *Microsoft Windows*, OS/2, and in assembly language modules that are linked with C or other high-level language programs (in C programs, DGROUP also contains the "local heap," which is used by the C run-time library for dynamic allocation of small amounts of memory).

The final Microsoft convention of interest to you when creating .EXE files is that of segment order. The high-level compilers assume that code segments always come first, followed by far data segments, followed by the near data segment, with the stack last (see the diagram "Memory Image of a 'Small Model' MASM Program"). This will probably not concern you much unless you are integrating assembler code with routines from C or other language libraries, but it's better to go along with the convention and build up the right habits now than it is to relearn the rules later.

The various directives required to segment your .EXE program properly may seem like a lot of extra overhead at first, and you may well wonder why you should bother with them. After all, you're not likely to be writing assembly language programs larger than 64K very often!

Memory Image of a "Small Model" MASM Program



This diagram represents the memory image of a typical "small model" MASM program just after loading. This program follows the Microsoft high-level language conventions for segment order and naming.

There are, however, a number of other arguments in favor of writing .EXE instead of .COM programs.

1. Functionally, it makes for more robust programs. If a program happens to

write in the wrong place in the data segment, it is somewhat less likely to crash horribly than if it writes in the wrong place in the code segment. In a .COM file, where code and data are intermixed, code is as likely to get bashed as data.

2. It gives you a head start on upward mobility. Microsoft's new OS/2 operating system does not support .COM-type programs in protected mode, whereas MS-DOS .EXE programs can be converted for OS/2 protected mode in a fairly straightforward manner. This aspect of OS/2 is in fact a hardware constraint: the 80286 or 80386 processors, when running in protected mode, absolutely enforce the restriction that segments containing machine code are not writable, and segments containing data are not executable.

3. It lets you use more-sophisticated debugging tools. The new Version 2.0 of *CodeView* distributed with MASM 5.0, which supports source code-directed debugging of assembler programs, can be used to its full potential only with .EXE files.

PROGRAM PROCEDURES The procedure level of MASM program structure is partly real and partly conceptual. Procedures within a program are declared with the PROC and ENDP directives in the following form:

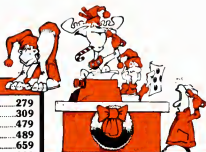
```
name PROC attribute
.
.
.
RET
name ENDP
```

This is basically just a fancy guise for a subroutine. The attribute carried by a PROC declaration, which is either NEAR or FAR, tells the assembler what type of call you expect to use to enter the subroutine, i.e., whether the subroutine will be called from other routines in the same segment or from routines in other segments. The assembler uses this information to generate the right opcode for a near (intra-segment) or far (intersegment) return, when you use the RET mnemonic within the procedure.

Each program should have a primary procedure that receives control from MS-



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```

name myprog
page 55,132
title 'MYPROG - segmentation skeleton'
dosseg ; use Microsoft segment order
.model small ; create small model program

miscellaneous equates
* ; structures, and other
* ; declarations go here

.code ; open code segment

main proc ; the routine which initially
; receives control

mov ax,@data ; set DS = our data segment
mov ds,ax
*
*
mov ax,4c00h ; the main routine terminates
int 21h ; and passes a return code

main endp

* ; other procedures needed by
* ; the program go here
*

.data ; open data segment
* ; all read/writes or static
* ; data go in this segment

.stack 256 ; declare stack segment

end main ; defines the entry point

```

Figure 2: A segmentation skeleton for a small model. EXE program written in assembly language, using the simplified segment directives of MASM 5.0. Note that use of the `.MODEL` directive eliminates the need for the `GROUP` and `ASSUME` directives, and that the `.CODE`, `.DATA`, and `.STACK` directives automatically declare segments with names and attributes that follow the Microsoft conventions.

of DGROUP, and use of ASSUME in this skeleton all follow the Microsoft conventions. Note that this is a small model program, with one code segment, one data segment, and one stack segment.

In Microsoft MASM 5.0, a number of new directives have been added that allow you to achieve your program segmentation and abide by all the Microsoft conventions in a rather painless way. The DOSSEG instruction causes the Microsoft segment order to be used. The .MODEL directive defines the number and types of segments, assigns the correct default attribute for procedures, and generates implicit ASSUME

and GROUP statements. The .CODE, .DATA, and .STACK directives automatically produce the proper segmentation declarations and assign each their proper attributes.

Figure 2 is thus the equivalent of the listing in Figure 1, but it uses the new MASM 5.0 simplified segment directives. You can readily see that these MASM 5.0 enhancements can save you lots of time and aggravation, especially when you venture into mixed-language programming. ☐

Ray Duncan is a contributing editor of PC Magazine.

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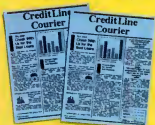
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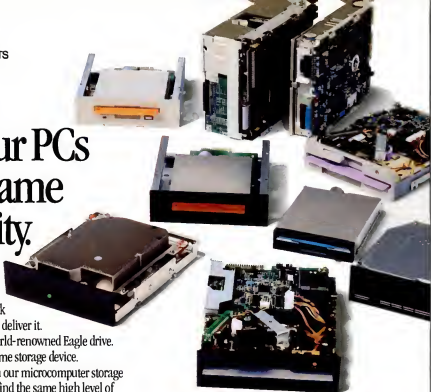
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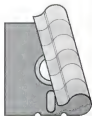
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SPREADSHEET CLINIC



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AUTOEXEC CONTROL

I was recently working on a 1-2-3 spreadsheet that contained an autoexec macro. This macro immediately loaded another spreadsheet, so the one I was working on would quickly disappear unless I was fast enough to hit Ctrl-Break in time to abort the autoexec. This was clumsy, so I discovered a trick to solve the problem more satisfactorily.

Before loading the original file, I put 1-2-3 into single-step mode by hitting Alt-F2 (Alt-F1 for Release 1A). This way, the macro does not execute immediately on loading but waits patiently for me to hit a key before starting to run. This gave me plenty of time to abort it with Ctrl-Break so as to analyze the spreadsheet.

Alan Tiet
Los Angeles, California

There are several ways to keep autoexec macros from running immediately. The obvious way is to rename them temporarily. A less-obvious technique is to blank the 1-2-3 screen and then /File Combine Copy the spreadsheet that contains the autoexec. The autoexec won't run, and you can rename it and analyze it all you want.

Mr. Tiet's method is quick and easy, but there is one kind of autoexec macro with which it will not work. Recently (Volume 6 Number 20), this column included a spreadsheet security autoexec macro by Michael King that began with {breakoff}. If {breakoff} is the very first autoexec command, it will take effect and disable Ctrl-Break even if the spreadsheet is in single-step mode. You will be in single-step, of

course, but all you can do is cycle helplessly through the macro, one keystroke at a time. Such is the power of {breakoff}. The /File Combine approach is the only way that I know to get around an autoexec macro like this.

FAIL-SAFE MACROS

Some 1-2-3 macros make major changes in your data and can wreak havoc if you run them at the wrong time. There are several ways to remind the user to think twice about running a macro. One is to include a {getlabel} command that prompts the user for a Y or an N. The macro can then continue conditionally. Unfortunately, it soon becomes habit to add the Y response as soon as you run the macro. Alt-A soon becomes Alt-AY, and all protection is lost.

The method I prefer requires the user to put the cursor in a specific location before he can run a dangerous macro. This takes a little more effort than typing Y, and it does give the user a visual reminder of what is about to happen. In the example shown in Figure 1, the macro erases a range named DATA, which could be anywhere. Unless the cursor is on the cell that contains the la-

bel ERASE, however, \A will not branch to the A_OK routine that actually erases the data.

If you had several routines of this type, you could put the enabling labels all together in a menu area in the worksheet. When one of the routines was run, the cursor would go to this area and the user would move the cursor to make the appropriate choice.

Loren Krienke
San Diego, California

Applications builders always have to decide whether to treat users as simpletons, geniuses, or something in between. It's nice to be reminded if a routine can produce a possible catastrophe, but it's irksome to be always pestered with prompts.

The ideal, of course, is to interrupt the user only when he is about to do something dangerous or out of the ordinary. In an example like our reader's, it's possible to run checks on the status of the data before deleting it. If the data normally is processed in some way before it's deleted, you could set flags to indicate what has happened to the data since it was entered. If

```
ERASE    <---- Put pointer here to enable macro [Alt]-A.

\A      {if @cellpointer("contents")="ERASE"}{branch A_OK}
        {beep}{return}

A_OK    /reDATA"
```

Figure 1: A fail-safe macro that will run only when the cursor is on the cell containing the label ERASE.

■ SPREADSHEET CLINIC

the user wanted to delete unprocessed data, you might then branch to a manual override routine like the one shown here.

All user interfaces should be moving toward this kind of added intelligence.

EASY DATA ENTRY

Databases in 1-2-3 take the general form of the small database in Figure 2. Each record is in one row, and fields are the cells in the row. It's relatively easy to add records to this database, since there are not many fields, and they all fit on the screen.

For wider databases, however, it is much easier to use a data entry macro of the kind shown in Figure 3. All the labels in the leftmost column are the range names for the cells to their right. Don't forget the colons in the last four labels. The only unlabeled range name is OLD_FORM, which is the four cells, NAME:, ADDRESS:, CITY:, and DONATION:.

The macro begins by asking if you want to add new records. If you enter a Y, it sends the cursor to the first line in the entry form. You then enter the information you want to include in the new record. In this case, since there is only one {?} pause in line 2 of the macro, you should enter new information by hitting the Down Arrow. If you prefer to enter each label with the Enter key, you could use a {?} pause for each field. When the new record is finished, hit Enter, and the {put} commands enter the data into the database. Note that the DONATION: field is numeric, and that the {put} command enters a value into the database. After each new record, the macro blanks the entry form and the range named GO_ON, and loops back to the initial prompt. When you are finished entering new records, type N at the prompt.

Skip Ulinski
Port Richey, Florida

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3 NAME:	ADDRESS:	CITY:	DONATION:
4 Charles Dickens	4 Pickwick Place	London	\$12.00
5 Sinclair Lewis	12 Main Street	Gopher Prairie	\$15.00
6			
7			
8			

RANGE NAMES:			
NAME	C3..C22	Ranges should include	
ADDRESS	D3..D22	as many rows as you	
CITY	E3..E22	expect the database	
DONATION	F3..F22	to contain.	

Figure 2: The database that is built by the macro in Figure 3.

\A		{GETLABEL "ADD FORMS Y/N ",GO_ON}{IF GO_ON="N"}{QUIT}
		{GOTO}OLD_FORM{?}
		{PUT NAME,0,@COUNT{NAME},@CELL{"CONTENTS",NAME:}}
		{PUT ADDRESS,0,@COUNT{ADDRESS},@CELL{"CONTENTS",ADDRESS:}}
		{PUT CITY,0,@COUNT{CITY},@CELL{"CONTENTS",CITY:}}
		{PUT DONATION,0,@COUNT{DONATION},@VALUE{DONATION:}}
		{BLANK OLD_FORM}
		{BRANCH \A}
GO_ON		N
ENTRY FORM:		
NAME:		
ADDRESS:		
CITY:		
DONATION:		

Figure 3: A macro that simplifies entering 1-2-3 data records.

I like the way the {put} statements work in this macro. They figure out how far down in the database to put each new record by doing an @ count of the number of records already there.

However, I don't like having to answer the ADD FORMS Y/N prompt all the time. I'd leave that out completely and just get out of the loop with Ctrl-Break. If you think Ctrl-Break is inelegant, you can always put in a test for the data entered in the NAME: field. If it consisted, for example, of a single X, you could skip the {put} statements, blank OLD_FORM, and quit.

Furthermore, the macro would be safer with a {?} pause for each field, with an optional {down} command to move the cursor to the next field. Otherwise, if you mistakenly hit Enter before you have entered the data for each field, you end up with a partial record in your database, which you have to go fix.

CROSS MULTIPLYING

When you build spreadsheets, you often have to multiply a range of cells by another range. An example of this is shown below in Figure 4, where the quantities in column B are multiplied by the prices in column D to obtain a total value for an inventory or an invoice.

If you were using 1-2-3, you would have to multiply each quantity by each price and then add all three products. With Framework II, however, you can write a new @ function that allows you to multiply one range by another. This is the solution that is used in Figure 4. The formula for the TOTAL cell, D9, is reproduced below it as text.

In order to use the new function, which I have called @crossmult, just create a frame in your Library Cabinet and call it crossmult. Type in the FRED program in Figure 5. The lines that start with semico-

A	B	C	D
3	Quantity	Stock #	Price
4			
5	36	EX-47	7.73
6	4	EX-17	14.25
7	12	AT-12	3.56
8			
9	TOTAL		\$378.00

Formula: @crossmult(b5:b7,d5:d7)

Figure 4: A Framework II spreadsheet that uses the user-defined function @crossmult.

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■ SPREADSHEET CLINIC

```

; create a local variable to put our working total in
@local (subtotal),
; loop through cells until there are no more
@while(
  @get(@item1)<>@NULL,
  ; make sure we got a legitimate number from both cells before
  ; multiplying them
  @if(
    @end(@isnumeric(@get(@item1)), @isnumeric(@get(@item2))),

```

```

    subtotal := subtotal+@get(@item1)*@get(@item2)
  ),
  ; move to next cell in first row
  @next(@item1),
  ; move to next cell in second row
  @next(@item2)
),
; return the formula answer
@return(subtotal)

```

Figure 5: A Framework II program that creates a new @t function called @t crossmath.

lions are comments that help other users understand this program, and do not have to be typed. Without them, the program is really quite short.

This feature in Framework that allows you to write custom @t functions makes it much more flexible than 1-2-3, in which it seems you always have to write macros in order to solve problems.

Charles Carroll
Rockville, Maryland

The ability to change the computing environment so easily is one of Framework's great strengths. There are several new spreadsheets to be released soon that will also permit you to design your own functions. Before much longer, this should be a standard feature of any self-respecting spreadsheet.

Jared Taylor is West Coast editor of PC Magazine.

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CIRCLE 215 ON READER SERVICE CARD

■ PAUL SOMERSON

USER-TO-USER



A powerful trio of utilities to enhance text displays in batch files, and a handy tool for controlling all of your system's shift states.

LOCKED UP

LOX.COM, created by assembling the LOX.ASM assembler code in Figure 1 or the BASIC LOX.BAS program in Figure 2, is a simple program that gives you software control over the CapsLock, NumLock, ScrollLock, and Insert status. These four status bits are located in the high nibble of byte 417 of the BIOS data area, at segment 0. The program can set or clear any of the four bits.

Once you've created the program, enter LOX followed by any combination of the characters +, -, C, I, N, or S. The four letters stand for the four status bits: Caps,

Insert, Num, and Scroll. The plus sign tells the program to set the bits for all following parameters, while the minus sign tells the program to clear the bits for all following parameters. If it finds parameters at the beginning of the command tail, before any plus or minus signs, it treats them as set parameters.

For example: LOX C sets CapsLock; LOX -N clears NumLock; LOX S-C sets ScrollLock and clears CapsLock; LOX -N+IC clears NumLock and sets Insert and CapsLock; and LOX CNIS sets all four locks. The program can handle shift states in any order, and in upper-

lowercase. And it ignores any illegal parameters.

It begins by moving the keyboard status bit to AL, and the command tail length to CX, to control the loop. Then it reads each byte in the command tail. It maintains AH as a set/clear flag; if it finds a plus sign it sets AH to one; if it finds a minus sign it sets AH to zero.

If it finds anything else, it first converts it to uppercase if necessary, and then checks to see if it is one of the four valid parameters. If it is, it moves the appropriate code into DH, and then ORs DH with AL to set the bit, or else NOTs and then

```

CSEG SEGMENT PARA
ORG 100H
ASSUME CS:CSEG, DS:CSEG, ES:CSEG, SS:CSEG

LOX PROC NEAR
    MOV AX,0
    MOV ES,AX
    MOV BX,417H
    MOV AL,BX:[BX]
    MOV BX,0
    MOV AH,1
    MOV CX,CX
    MOV CX,BYTE PTR [BX]
    CMP CX,0
    JE DONE
    SUB CX,1
    INC BX
    MOV DX,BYTE PTR [BX]
    MOV DX,20H
    JRE PLUCK
    MOV AH,AX
    JND MORE
    PLUCK: CMP DL,20H
    JNE INSCX
    MOV AH,1
    JND MORE
    INSCX: CMP DL,61H
    JLE OK
    SUB DL,20H
    OK: CMP DL,4FH
    JNE CAPCX
    JND MORE
    CAPCX: CMP DL,43H
    JNE INSCX
    MOV DH,40H
    JND MORE
    INSCX: CMP DL,40H
    JNE SCRCX
    MOV DH,50H
    JND MORE
    SCRCX: CMP DL,51H
    JNE MORE
    MOV DH,10H
    RETLOX: CMP AH,0
    JE CLCLOX
    OR AL,DH
    JND MORE
    CLCLOX: JND DH
    AND AL,DH
    MORE: LOOP INSCX
    MOV BX,417H
    MOV ES:[BX],AL
    DONE: MOV AX,4CH
    MOV AX,0
    INT 21H

LOX ENDP
CSEG ENDS

END LOX

```

Figure 1: LOX.ASM code to create LOX.COM shift status controller. Syntax is LOX -/+ CNI

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CIRCLE 254 ON READER SERVICE CARD

■ USER-TO-USER

```

100 ' Program to create LOX.COM -- by Grinnell Almy
110 CLS:PRINT "Checking Data; please wait..."
120 FOR B=1 TO 8:FOR C=1 TO 16:READ A$:T=T+VAL("H"+A$):NEXT
130 READ S:IF S<>T THEN PRINT "ERROR IN LINE";B=1+16:END
140 T=S:NEXT:RESTORE
150 OPEN "LOX.COM" AS #1 LEN=1:FIELD #1,1 AS D$
160 FOR B=1 TO 8:FOR C=1 TO 16:READ A$
170 LSET D$=CHR$(VAL("H"+A$)):PUT #1:NEXT:READ DUMMYS:NEXT
180 CLOSE:PRINT "LOX.COM CREATED"
190 DATA B8,88,08,8E,C8,B8,17,84,26,8A,87,BB,86,88,B4,81,1411
200 DATA 33,C9,8A,2F,83,F9,88,74,5E,83,E9,81,43,43,8A,17,1655
210 DATA 88,FA,2D,75,85,32,E4,8E,46,98,88,FA,2B,75,85,B4,1955
220 DATA 81,EB,3C,98,88,FA,61,7C,83,88,EA,28,88,FA,49,75,2884
230 DATA 85,B6,88,EB,1C,98,88,FA,43,75,85,B6,48,EB,12,98,1932
240 DATA 88,FA,4E,75,85,B6,28,EB,88,98,88,FA,53,75,18,B6,1955
250 DATA 18,88,FC,88,74,85,8A,C6,EB,85,98,FE,D6,22,C6,E2,2827
260 DATA AC,BB,17,84,26,88,87,84,4C,88,88,CD,21,88,88,88,1237

```

Figure 2: LOX.BAS program to create LOX.COM shift status controller. Syntax is LOX -/+ CNSI (where C, N, S, and I = CapsLock, NumLock, ShiftLock, and Insert; + = on; - = off).

ANDs it with AL to clear the bit, depending on the status of AH. The program then loops back to read another byte from the command line. When the command line is exhausted, it moves AL back to the keyboard status byte.

Grinnell Almy
Santa Monica, California

This program is especially useful now that IBM delivers systems that automatically set the NumLock on at boot-up. You may want to include a LOX -N line in your AUTOEXEC.BAT to fix this problem.

BATCH POWER TRIO

DOS doesn't provide decent batch utilities for displaying text, so I wrote three short ones to give your batch files powerful on-screen abilities—LOCATE.COM, WAIT.COM, and ECHO.COM.

LOCATE positions text wherever you want it. WAIT delays batch file execution a specified number of seconds or until any key is struck. ECHO prints a message in reverse video. To create these, assemble the ASM source code in Figure 3, or run the BASIC BATFILES.BAS program in Figure 4.

LOCATE.COM One of BASIC's most useful screen controls is its LOCATE command. LOCATE.COM does the same thing for batch programs. It lets you position the cursor anywhere on the screen for

subsequent ECHO or ECHO commands. Be sure to begin with ECHO OFF and use a separate LOCATE statement for each new line. Also, to avoid scrolling the screen unintentionally, don't LOCATE to row 24.

LOCATE also lets you erase text from the screen. To do this, LOCATE over the existing text and echo a string of blanks followed by a NUL character (ASCII 255). Also, you can create flashing images with LOCATE and ECHO. Just repeatedly ECHO the same text on top of itself. Each time the message is written in reverse video, it will flash on the screen to really catch your attention.

WAIT.COM WAIT lets you insert a pause into your batch program. For example, WAIT 5 will pause for 5 seconds or until you strike any key. This lets you keep a screen displayed long enough to read it before proceeding. (To display complex title screens or menus quickly, just put the entire screen in a normal text file and then TYPE them from the batch file.)

Since WAIT uses DOS's clock to time the delay interval, it works accurately on any machine. Simpler methods that use delay loops are at the mercy of the processor speed and won't give consistent results. The longest single wait interval you can request is 59 seconds. For longer pauses, use multiple WAIT statements.

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CIRCLE 183 ON READER SERVICE CARD

```

CSEG                                SET
                                   ER00
                                   ER01                                STARTY

; WAIT4ASH - passes a batch file to Tom Kihikos
CSEG
SUBROUTINE
ADDRESS C1C000, A1C000, A1C000
ORG 1000
MOV R1, R0                                ;point to parameter area
MOV A0, A1                                ;clear A0 for total
READ_CHAR:
MOV R0, R1                                ;get character into R0
JNC ST                                     ;point to next character
COP R0, R00
JE DONE_READING
R0A R0, R00                                ;convert ascii to integer
JC READ_CHAR;is it a valid digit?
COP R0, 0
JA READ_CHAR

;
MOV R0, 10                                ;times 10 for next digit
MUL R0
ADD R0, R1                                ;add digit to sum
JMP READ_CHAR;read all characters on line

;
DONE_READING:
MOV R0, R1
MOV A1, 2CH
INT 21H                                ;DOS get time function
ADD R0, A1
MOV R0, A1
COP R0, R0
JL MATH
R0A R0, 6H
JMP CHECK_FOR_NAN

;
MATH:
MOV A1, 2CH
INT 21H
COP R0, R0

```

(continues)

(continues)

Figure 3: ASM code to create LOCATE.COM, WAIT.COM, and ECHO.COM.

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[illegible]

(Figure 3 ends)

by pressing any key. WAIT detects this by continually checking the keyboard buffer while it loops. If a keystroke is detected, the pause state is terminated and the input key is discarded.

ECOH.COM The DOS ECHO command provides a simple way to display messages from within a batch file. ECOH.COM is similar, except it displays the message in reverse video.

ECOH.COM works by first obtaining the screen color attribute at the current cursor position. It then performs a bit rotation on the attribute to exchange the background and foreground colors. This cre-

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Stan Miastkowski,
BYTE, March 1987



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QIC 386-A

Basic system

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QIC 286-12C

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QIC 286-10B

Basic system

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QIC 286-QT QIC 286-10A

Basic system

80286 running at 6 / 8 and 8 / 10 MHz, 512K DRAM expandable to 1024K, six 16-bit and two 8-bit expansion slots, 1.2MB floppy / 84 key keyboard, combined floppy and hard disk controller, 192W power supply, system clock / calendar with battery backup.

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■ EDITED BY CRAIG STARK

POWER USER



Protecting passwords in dBASE; faster spelling checks in Word; dangerous dBASE bug; simulating the DOS prompt in dBASE; listing a file's structure without loading dBASE.

PASSWORD PROTECTION

Because dBASE doesn't offer built-in password protection, we use PASSWORD.PRG (Figure 1) to limit access to our company's sensitive procedures and data. The problem with most passwords is that someone passing by might see the password as an authorized user types it in. Here we "SET CONSOLE OFF" so the keystrokes never appear on the screen. Moreover, the format makes it appear that the password is only three characters long—in fact, it's four.

To prevent a more determined snooper from simply reading the program code and seeing the password, we run the finished programming through dBASE III Plus's dBCODE utility, which encrypts the code and also makes it run faster.

Teong Chye Lee
Kuala Lumpur, Malaysia

Often the simplest solution is the best. Mr. Lee's password code, "XXX"+Spacebar [Now he'll have to change it—Ed.], is easy to remember and painless to enter, but the subtle touch of formatting the screen for three letters would cause an unauthorized user to wear his fingers out typing three-letter combinations (note that "XXX"+<Enter> doesn't get it). Nice.

In a more complex situation, different passwords could be used to provide higher levels of access. You might prefer to give the user more than one chance to enter the correct password. And, if an unauthorized user attempts to enter your program, you might want to do more than simply QUIT (see the item "Pay Up or Lock Up," Pow-

er User, Volume 5 Number 22).

Mr. Lee's suggestion about dBCODE is worth heeding—it's easy to overlook this utility, which is included with dBLINKER on the dBASE III Plus Utilities Disk. It's the simplest way to "protect" valuable code. dBCODEd programs also execute faster because comment lines and indentations are removed for you. A major drawback of dBCODE, however, is that (like Clipper) it doesn't support many of the interactive commands, such as EDIT or BROWSE.—Brad Stark

```
*** PASSWORD.PRG
CLEAR
SET TALK OFF
SET CONSOLE OFF
PRIV pass,p1,p2,p3,p4
pass="XXX "
@ 18,26 TO 12,58 DOUBLE
@ 11,29 SAY "ENTER PASSWORD:  "
@ 11,44 SAY " "
WAIT "" TO p1
@ 11,45 SAY ""
WAIT "" TO p2
@ 11,46 SAY ""
WAIT "" TO p3
@ 11,47 SAY ""
WAIT "" TO p4
SET CONSOLE ON
IF .NOT. UPPER(p1+p2+p3+p4)=pass
SET ESCAPE OFF
temp=9
cloop="BAD PASSWORD—ACCESS DENIED: "
DO WHILE temp<18
  ?? CHR(?)
  @ 14+temp,23 GET cloop
  temp=temp+1
ENDDO
QUIT
KEND
ELSE
  RELE p1,p2,p3,p4,pass
  * Password OK, enter program
RETURN
```

Figure 1: A rather subtle dBASE password-protection program.

CHECKING SINGLE WORDS

Microsoft Word's spelling checker is fine for checking entire documents, but it is not designed to handle individual words. For a fast check of a single word, use the Escape Library Run command and type WORDFIND at the prompt. The wildcard characters ? and * will let you look for patterns as well as for whole words. Once the matching words are displayed, hitting the Return key will put your document back onscreen. To save additional keystrokes, you can rename the utility WORDFIND.COM to WF.COM.

Jim Levitt
Wolverton, Minnesota

Information about WORDFIND is buried in Appendix F of the Word reference manual under "Additional Spell Tools," and once found, the explanation is geared toward finding words for filling in crossword puzzles. But as a more general writing tool, you can use WORDFIND's pattern-matching feature to determine the proper ending of a root word, for example. (Is it chargeable, chargeble, or chargeable? Look up charge.)*

An even better way to save keystrokes is to define a one-keystroke macro in ProKey, SuperKey, or the like to call up WORDFIND. Unfortunately, however, once you find the right spelling, you still have to type it manually into your document.—M. David Stone

III PLUS TIME BOMB

After much hair-pulling and an anxious call to Ashton-Tate, I learned that the ON

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■ POWER USER

ERROR in *dBASE III Plus* fails to trap some common problems, such as Error [56], "Disk full when writing file: filename", and Error [52], "No database in USE. Enter filename:".

Error [56] is a time bomb. When it occurs, you can't CLOSE the file that was being written when the disk overflowed or USE it to see what it contains. The only choice is to QUIT, reenter *dBASE*, and recover what you can. The file you were writing has zero records.

Error [52] is less serious—you can trap it with

```
IF CHR(8)=DBF()
  * do file select routine
```

ENDIF

The DBF() function returns a null string if no database is in USE in the current work area. Note that this trap must precede the error; once a user attempts to access data in a closed area, Error [52] pops onto the screen.

Darryl Nichols
Fairfax Station, Virginia

Mr. Nichols's letter highlights a dangerous situation in dBASE III, Clipper, and FoxBASE. According to Ashton-Tate, Errors [52] and [56] are the only "true errors" that are not trapped by ON ERROR in dBASE III Plus, Version 1.1. However,

■ Error [56] is a time bomb. When it occurs, you can't CLOSE the file that was being written when the disk overflowed or USE it to see what it contains.

there is some additional fine print.

Messages and questions like "No Find" or "filename already exists... overwrite (Y/N)"—which you might consider error messages—are classed as "status messages" or "safety messages,"

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■ Error [56] is a time bomb. When it occurs, you can't CLOSE the file that was being written when the disk overflowed or USE it to see what it contains.

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■ POWER USER

and they, too, will not be tripped by ON ERROR.

Other untrapped error messages are those issued from inside special functions, such as BROWSE or MODIFY REPORT.

Furthermore, all error messages without a {##} next to them in the manual will go untrapped. This includes some disastrous conditions like "Not enough disk space for sort." Another pitfall occurs when the user attempts to access an empty floppy drive: DOS's "Abort, Retry, Ignore" comes up and, of course, Abort crashes dBASE without closing the files.

After calling Ashton-Tate, I put on my Sherlock Holmes cape and entered

```
ON ERROR ? "Elementary, my dear Watson.;"
+* IT'S ERROR +STR(ERROR(),3)
```

I passed over the miscellaneous stuff: error messages relating to ASSIST, CATALOG/VIEW, importing .SYLK files, multiusers, dBRUN, and internal dBASE errors like "Damaged Index." Still, it didn't take a magnifying glass to find more errors in Ashton-Tate's list of untrapped errors:

- [39] Numeric overflow—data was lost
- [89] Cannot erase open file

Frankly, I think that Ashton-Tate should know which errors are trapped and which aren't. After testing and confirming the above, the technical representative said he would recommend that Ashton-Tate retest ON ERROR trapping systematically. Good idea.

The most serious untrapped Error is [56] Disk Full, of course. Picture yourself as a novice user. Suddenly you're told that the disk is full and asked "Abort, Ignore, Delete?" Some choice! You can't select Ignore—it just LOOPS forever—so why is it even a choice? You shudder to think of deleting files, so the least awful choice is Abort, right?

If you choose Abort, the screen flashes ""***WARNING***Data will probably be lost. Confirm (Y/N)." Confirm what? If you say "N", you're back to "Abort, Ignore, Delete." If you toagh it out, you have no choice but to confirm Abort—and "data will probably be lost." At that point, you're greeted with "Press <Enter> to assent to License Agreement & begin dBASE III Plus." and the instant you touch any key, dBASE CANCELs out of

the program, stranding you at the dot prompt. The files are wide open, and serious damage has already occurred (the file you were writing is unreadable).

Don't feel smug just because you've graduated to Clipper or FoxBASE. Clipper doesn't support ON ERROR at all, and if an error occurs, there's no dot prompt to help you put things back together again. FoxBASE does trap Error [56] with ON ERROR, but you'd better write a whole of a recovery routine: I found newly appended records blank and the active databases locked out—you can't access them or close them—so the only alternative is to QUIT and restart. Your original file may be intact and renamed ".BAK"—you should check it first. If you were sorting when the disk overflowed, just erase the scratch files starting "0".

Both Clipper and FoxBASE score better than dBASE on Disk Full errors because they have additional fancious like DISKSPACE() so a programmer can trap the error in advance. But when Error [39] occurs in either FoxBASE or Clipper, processing continues blithely unaware that a numeric overflow has just corrupted your TOTAL ON file.

In other words, if you want to create an absolutely bulletproof "black box" program in the dBASE language, you'd better learn to avoid death and taxes first. —Brad Stark

DOS PROMPT IN dBASE

It's sometimes convenient to be able to simulate the DOS prompt from within an otherwise black-boxed dBASE application. DOSPROM.PRG, shown in Figure 2, is the complement of DOTPROM.PRG

(Power User, Volume 6 Number 2). If the programmer wants the utility of accessing DOS during development or debugging but doesn't want the end user messing around in DOS, he can hide the option in the menu. Naturally, to run DOS commands from within an application you need enough memory to load COMMAND.COM plus other programs called.

Rainer F. Glaap
Cologne, West Germany

Since your program will probably have open files when this routine is used, I would expand the prompt to include a warning:

```
B ROW(,3 SAY [Please enter a DOS command]
?? [ don't copy an open file] <CR>=Xit]
```

If you want to get really fancy, you can trap all commands where doscom begins with the verb COPY or XCOPY before it issues the command RUN &doscom.

You may prefer different placement of the simulated DOS prompt, or even to CLEAR the entire screen. Finally, Clipper users should be sure to SAVE SCREEN before entering this routine, then RESTORE it afterwards. —Brad Stark

LISTING.DBF STRUCTURE

Often when documenting a dBASE system, it would be handy to list out a file's structure without having to load dBASE. The Microsoft C 4.0 program called DBHEAD.C (Figure 3) produces a DOS executable program that emulates dBASE's LIST STRUCTURE command. To execute DBHEAD.EXE from DOS, enter

```
DBHEAD [d:\path\]dbfile[.ext] [> device]
```

```
*** DOSPROM.PRG
@ 28,8 CLEAR
doscom=CHR(255)
DO WHILE doscom=" "
?
@ ROW(,3 SAY [Please enter a DOS command] <CR>=Xit]
ACCE ">" TO doscom
IF doscom=" "
RUN &doscom
ENDIF
ENDD
RETRU
```

Figure 2: Simulating DOS from inside a dBASE program.

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■ POWER USER

```

/* DBHEAD.C */
#include <stdio.h>
#include <fcntl.h>
#include <sys/types.h>
#include <sys/stat.h>
#include <string.h>
#include <in.h>

struct dbcnt {
    unsigned char memo;
    unsigned char updt;
    unsigned char updt;
    unsigned char updt;
    unsigned long nrecs;
    unsigned short frcp;
    unsigned short recsize;
    char filler[20];
};

struct fld {
    char fname[11];
    char type;
    char filler[4];
    unsigned char flen;
    unsigned char deep;
    char fill[14];
};

#define fmode 0_RDONLY|O_BINARY

main(argc, argv)
int argc;
char *argv[];
{
    struct dbcnt cntents;
    struct fld dbfields;

    unsigned short fhandle, bytes, nfile;
    nfile = 65536;

    if (argc != 2) {
        fprintf(stderr, "Usage: dbhead d:\\path\\dbfile > device\\n");
        exit(1);
    }

    strcpy(file, ++argv);
    get_ext(file, ext);
    if (strlen(ext) == 0) {
        strcpy(file, ".dbf");
    } else {
        if (strcmp(ext, ".dbf") != 0) {
            fprintf(stderr, "Invalid file extension: %s\\n", ext);
            exit(2);
        }
    }

    structp(file);

    if ((fhandle = open(file, fmode)) == -1) {
        fprintf(stderr, "Can't open %s\\n", file);
        exit(3);
    }

    if (bytes = read(fhandle, cntents, 32) != 32) {
        fprintf(stderr, "Can't read header contents\\n");
        close(fhandle);
        exit(4);
    }

    printf("DBase III file: %s\\n", file);
    if (cntents.memo == 0x03)
        printf("Database contents memo field(s)\\n");
    printf("Last Updated: %02u/%02u/%02u\\n", cntents.updt,
        cntents.updt, cntents.updt);
    printf("Record size: %05u\\n", cntents.recsize);
    printf("Records: %05u\\n", cntents.nrecs);
    nfile = (cntents.frcp - 1) / 32 + 1;
    printf("# of fields: %05u\\n", nfile);

    printf("Name Type Len Desc\\n");
    printf("-----");
    for (i = 1; i <= nfile; i++) {
        if (bytes = read(fhandle, dbfields, 32) != 32) {
            fprintf(stderr, "Can't read field contents\\n");
            nfile--;
            exit(5);
        }
        printf("%s-%05u to %05u %05u\\n", dbfields.fname,
            dbfields.type, dbfields.flen, dbfields.deep);
    }
    close(fhandle);
    exit(6);
}

/* get_ext
** pass file name in "s"
** returns ext in "e"
**
*/
get_ext(s, e)
char s[], e[];
{
    char *p;
    p = strchr(s, '.');
    if (p == 0) {
        for (p = s; *p; p++)
            *p = '\0';
    } else
        *p = '\0';
    return;
}

```

Figure 3: The Microsoft C source code for DBHEAD.EXE.

If the .DBF extension is omitted, the program will append it. The output can be redirected to a printer or a file for use in a word processor.

James L. Ellis
Plainfield, New Jersey

If you have to work with multiple .DBF structures, or if you want to use your word processor for serious dBASE programming, you'll want a copy of this one. It reads dBASE III or dBASE III Plus structures from DOS and lists them in a concise format to your choice of output device. If you're like me, you will find

that it comes in handy when you've gone to the trouble of printing out the file structure but you just can't find the blasted thing when you need it.

The source code for DBHEAD.EXE is written in Microsoft C and is shown in Figure 3. Both this file and the fully compiled DBHEAD.EXE files can be downloaded by modem from the PC Magazine Interactive Reader Service, (212) 696-0360.—Brad Stark

Craig L. Stark is senior editor for technical columns of PC Magazine. Brad Stark is a dBASE programmer and consultant

based in Scituate, Massachusetts. M. David Stone is a contributing editor of PC Magazine.

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■ EDITED BY ROBERT L. HUMMEL

LANGUAGES



Undocumented and long-overdue ways to create QuickBASIC libraries; big banner-builder program; Turbo Pascal number formatting to separate your billions from your millions.

QUICKBASIC

MORE QB LIBRARY OPTIONS

The documentation for QuickBASIC's BuildLib utility implies that the only way to create a user library is to enter the name of each object module. This can be very tedious when trying to debug a single object module in a large library. An undocumented feature of BuildLib is the "/L" option, which lets you convert any library file created with LIB.EXE into a QuickBASIC user library.

Many advanced BASIC libraries sold by independent vendors are supplied in a .LIB format. The advantage of this is that you can maintain a large library of subprograms, both BASIC and assembler, using the LIB program that comes with the macro assembler. By using "/L" you can convert these into user libraries to be loaded into memory with the QB editor. Multiple libraries may be combined with one another by using the plus sign as you would normally do.

One problem you may encounter when building large libraries is getting a "Too Many Segments" error message from QuickBASIC. Since BuildLib is really just a variant of Link in disguise, you can also use the switches allowed by Link with BuildLib. To solve the "Too Many Segments" error, just include the switch "/SE:n", where n is the number of segments you wish to use for the library. N must be in the range 1-1024. Otherwise, the default is 128 segments.

Jens Yeager
Mentor, Ohio

These are very useful options, but they're not the only ones Microsoft failed to document in the QuickBASIC manual. You can also combine multiple object modules in a user library by specifying a response file instead of typing each module name.

To do this, first create a text file that contains the list of object modules to be included in the library. Put each name on a separate line, and add a plus sign after all but the last. When BuildLib asks for the object modules, enter an "at" sign (@), followed by the response filename.

Another great feature that somehow was omitted from the manuals is the linker's ability to pack an .EXE program file. By adding "/E" on the command line that starts Link, you tell it to create a packed file that can be up to 20 percent smaller than normal.

Speaking of linking, Microsoft really should include the Lib program with QuickBASIC. I use it all the time to main-

tain my assembler utilities, and it can also include precompiled BASIC programs in the same library. This way, instead of having to tell Link the name of each object module you can simply specify the library.—Ethan Winer

TURBO PASCAL

COMMA

Turbo Pascal allows the programmer to print real and integer numbers to the screen or printer in a flexible format. The decimal representation of a value can be output, right-justified in a field n characters wide with m digits after the decimal point. The n and m are programmer specified, e.g.,

```
WriteLn (RealNumber:n:m);
```

In most cases that is enough. However, if the number has many digits, it becomes difficult to read. This is usually overcome by inserting commas to separate the thousands, the millions, the billions, and so on. It is easier to read a number such as 1,234,567.89 than 1234567.89.

Turbo Pascal does not have built-in functions or procedures to insert commas into numbers. I have written a function, Comma, which does just that and is shown in Figure 1. This function returns a string that contains the decimal representation of VALUE, right-justified in a field FIELDWIDTH characters wide, with DEC numbers of digits after the decimal point. Commas separate the thousands, the millions, the billions, etc. The function adds an appropriate number of blanks to make the

■ Since QuickBASIC's BuildLib is a variant of Link in disguise, you can also use the switches allowed by Link with BuildLib.

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■ LANGUAGES

```

(SR,C-)
PROGRAM CommaDemo;
{ By Kim Agrawal, SAICE, Pondicherry 605002, INDIA
  The following function is placed in the public domain and
  can be used for any commercial or non-commercial purpose. }
TYPE
  longating = STRING(255);
VAR
  b : Real;
  a : Integer;

FUNCTION Comma(Value : Real; fieldwidth, dec : Byte) : longating;
CONST
  Space = ' ';
  comma = ',';
VAR
  temp : STRING(255);
  CommaInserted, i, CommaPos : Integer;
BEGIN
  IF fieldwidth < 8 THEN fieldwidth := 8;
  IF dec < 8 THEN dec := 8;
  IF dec > 24 THEN dec := 24;

  STR(value:fieldwidth:dec, temp);
  IF dec = 8 THEN CommaPos := Length(temp)-2
  ELSE CommaPos := Length(temp)-dec-3;
  CommaInserted := 0;
  WHILE (temp[CommaPos-1] <> Space) AND (CommaPos > 1) DO
    BEGIN
      Insert(comma, temp, CommaPos);
      CommaInserted := CommaInserted+1;
      CommaPos := CommaPos-3;
    END;
  FOR i := 1 TO CommaInserted DO
    IF temp[i] = Space THEN Delete(temp, 1, 1);
    Comma := temp;
  END;

  BEGIN
    WriteLn(' ', Comma(123456789.567, 28, 6), ' ');
    WriteLn(' ', Comma(1234567.567, 2, 2), ' ');
    a := 23456;
    b := 2345678.87;
    WriteLn(' ', Comma(a, 12, 4), Comma(b, 28, 3), ' ');
  END.

```

Figure 1: Comma function, for real-number formatting.

string FIELDWIDTH characters wide. If the number is longer than FIELDWIDTH, the returned string is as wide as the number. For example,

```
WriteLn(Comma(123456789.56, 22, 3);
```

will give 123,456,789.560 right-justified in a field 22 characters wide.

Kim Agrawal
Pondicherry, India

You may wonder why the function forces the DEC parameter to be from 0 to 24 only. If you specify a number outside that range, Turbo Pascal puts the number in scientific notation. That would be useless in this routine.—Neil J. Rubenking

BANNER

BANNER.PAS (Figure 2) is a simple Turbo Pascal program that accepts a string from the user and creates a corresponding banner on a dot matrix printer. If the user doesn't enter the string on the command line, BANNER asks for it directly.

The program works because the designers of the PC included a table of ASCII characters in ROM at \$F000:\$FA6E. BANNER compares each character in the user string with the ROM table. It looks at the character as a matrix of pixels. Starting with the leftmost column and bottom row of each character, the program determines whether the corresponding pixel is ON for that character. If the pixel in that row/column position is ON, then the program sends a solid block character to the printer.

```

(SV-,C-,R+)
PROGRAM Banner;
TYPE AnyString = STRING(255);
CONST RomCharsOffset = $FA6E; {Address of the ASCII table in ROM}
      BlockWidth = 8; {This value determines the size of ea. char}
      BlockChar = $177; {The full block char. used to print the banner}
      PrintChar : ARRAY[Byte] OF Char = (' ', BlockChar);
VAR
  Temp, W, X, Y, LRow, LCol : Integer;
  Parameter : AnyString;
  ChASCIIval : Byte;

PROCEDURE Initialize;
BEGIN
  CLRSCR; Parameter := '';
  IF ParamCount = 0 THEN
    BEGIN
      Write('Enter message: '); {If string is missing from the}
      ReadLn(Parameter); {command line, request it now.}
    END
  ELSE FOR X := 1 TO ParamCount DO
    Parameter := Parameter+ParamStr(X)+' ';
  END;
  {Initialize}

PROCEDURE WriteBanner(S : AnyString);
BEGIN
  {To see the characters on the SCREEN only, comment out next line}
  ConOutPut := LatOutPut; {Redirect I/O, since its so easy to do.}
  FOR W := 1 TO Length(S) DO {Loop from first char to last...}
    FOR LCol := 7 DOWNTO 8 {end from 1st col. of char to last...}
      FOR Y := 1 TO Round(BlockWidth/3) DO
        BEGIN
          FOR LRow := 7 DOWNTO 8 DO {And from bottom row of char to top}
            BEGIN
              Temp := Mem[$F000:$RomCharsOffset+(Ord(S[W])*8)+LRow];
              ChASCIIval := Temp SHR LCol;
              FOR X := 1 TO BlockWidth DO
                Write(PrintChar[Odd(ChASCIIval)]);
            END;
            WriteLn;
          END;
        END;
      {WriteBanner}
    END;
  BEGIN {Main}
    Initialize;
    WriteBanner(Parameter);
  END. {Main}

```

Figure 2: Banner-printing program.

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An example of the benefit of excellent code is a 32-bit matrix multiply. In this benchmark an NDP Fortran-386 program is run against the same program compiled with a 16-bit Fortran. Both programs were run on the same 80386 system. However, the 32-bit code ran 7.5 times faster than the 16-bit code, and 58.5 times faster than the 16-bit code executing on an IBM PC.

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■ LANGUAGES

Otherwise, it sends a space. It continues looking at each row/column, from bottom to top, for each character.

To use the program, simply type the program name followed by the text that you want printed out as a banner. The string may not exceed 255 characters in length. For example,

```
BANNER Hello, world!
```

would work.

Rick Gessner
Tempe, Arizona

If your printer won't print character 177, or prints it as something else, you can substitute the character of your choice. For example, if you want to print banners with the "û" character, you simply change the constant declaration near the top to

```
BlockChar = '@';
```

Do note that the WriteBanner routine takes a shortcut to get output to the printer. It sets OutPtr equal to LstOutPtr. This makes every plain "Write" go to the print-

■ To use BANNER, type the program name followed by the text that you want printed out as a banner.

er rather than to the screen. If you modify the program so it needs to write to the screen after WriteBanner runs, you'll want to eliminate that assignment and write directly to the LST device. Use

```
Write(Lst, PrintChar(odd(ChAsciiVal)));  
WriteLn(Lst);
```

in that case.—Neil J. Rubenking

Robert L. Hummel is senior technical editor on the staff of PC Magazine. Neil J. Rubenking is a contributing editor of PC Magazine. Ethan Wiener is a contributing editor of PC Magazine and also the owner of Crescent Software in East Norwalk, Connecticut.

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■ ROBERT L. HUMMEL

PC TUTOR

How DOS handles printer ports; working around a serious bug in early 8088 chips; getting border colors on an EGA monitor; executing hidden files.



PRINTER PORTS

How does DOS handle the printer ports? There seem to be three separate levels: PRN, the logical device name used by DOS; LPT1, LPT2, and LPT3, the logical device names that are used by the BIOS; and the actual hardware addresses 278h, 378h, and 3BCh.

What confuses me, however, is how DOS assigns these and how they can be changed. It appears that the BIOS or DOS scans the hardware during power-up and assigns LPT1 to the first valid printer port address it finds. Is there a translation table set up in RAM? If so, where is it located? How is it possible to change the port assigned to PRN?

Pete Nelson
Minneapolis, Minnesota

Most of the pieces of the printer puzzle are in your letter, so all that's needed is a little clarification. Each time your PC boots up, one of the ROM BIOS initialization routines scans the hardware looking for parallel (printer) port adapters. These adapters permit transfer of data from the computer to an external device.

Each adapter has built-in circuitry that allows it to exchange data and instructions with the CPU. This communication is accomplished through what is called an I/O port. Don't confuse this use of the term "port" with its use in the phrase "parallel port" above. The I/O port is used solely for communication internal to the PC.

I/O ports are identified by their address, which can range from 0 to 3FFh. (Again, don't let the similar terminology

lead you to confuse these addresses with memory addresses.) Of the possible 1,024 addresses, there are three assigned for use with parallel ports: 278h, 378h, and 3BCh.

The three master, or "base," addresses are tested, in order, for the presence of a valid parallel port adapter. As each device is found, its I/O port number is placed in a table in low memory at 0:408h. The table has room for up to four 16-bit entries. The first is stored at 0:408h, the second at 0:40Ah, and the third at 0:40Ch. When no more port adapters are found, the remaining table entries are set to zero. The total number of parallel ports found at boot-up is stored in the top two bits of the BIOS Equipment List word, which is located at 0:410h.

Let's assume you have only one parallel port adapter card, and it is configured

to respond to port 378h. That card will be available as printer 1. If you now install a second adapter, configured for 3BCh, your original card will still be printer 1; the new card will be assigned as printer 2. But, if the second adapter card you install is configured for 278h, it will become printer 1, and the old card will become printer 2.

When you print a character using the BIOS interrupt 17h service, you must specify the printer number in the DX register. This number is used as an offset into the port list table at 0:408h.

At the DOS level, there are four permissible device names that are associated with printers: PRN, LPT1, LPT2, and LPT3. PRN (PRiNter), meaning the default printer, is always a synonym for LPT1 (Line PRiNter 1).

Changing the physical printer that is associated with a DOS device name cannot be accomplished at the DOS command level. What you must do instead is change the port address in the BIOS port table. A short program by Charles Petzold that swaps the printers called LPT1 and LPT2 appeared in this column (Volume 6 Number 9) and is reprinted here as Figure 1.

To create this program, first make sure that DEBUG is in your current directory or in a directory accessed by your PATH command. Then simply start DEBUG and type in the instructions exactly as shown in Figure 1. Be sure to include the blank line—just an <Enter>—after the INT 20. This short DEBUG session will create the file PRNSWAP.COM. Running PRNSWAP switches the printers connect-

```
N PRNSWAP.COM
A 100
POP DS
MOV AX, [408]
XCHG AX, [40A]
MOV [408], AX
INT 20

R CX
D
W
Q
```

Figure 1: A short program you can create with DEBUG to toggle between printers connected as LPT1 and LPT2.



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■ PC TUTOR

ed to LPT1 and LPT2. Running it again switches them back.

DEFECTIVE 8088 CHIPS

I recently ran the system diagnostic routine from PC-Tools. The program informed me that I had an older CPU chip that was "found to allow interrupts after a change to the stack segment" and suggested I get a newer version of the CPU. Everything I have runs just fine now, but what impact might this have with newer software? If replacing the chip is a good idea, should I stay with an 8088 or try one of NEC's V-20 chips?

Dallas Brozik
Huntington, West Virginia

Some early 8088s did indeed have a defect that allowed interrupts after changing the stack segment register. This was (and is) a serious bug that should be attended to.

The stack is an area set aside in memory for temporary storage of program information and data. It's often likened to the device cafeterias use to store dinner plates. Plates are inserted from the top, or "pushed" onto the stack. When a plate is removed, or "popped" off the stack, the spring-loaded device moves the next plate into position. The last plate in is always the first plate removed. The stack is therefore called a "first-in-last-out" (FILO) or "last-in-first-out" (LILO) buffer.

The 8088 stack, of course, doesn't use plates, and it doesn't really move. Instead, an area is set aside in memory and two registers are set up as a pair to point to it. Of the 14 registers common to the 8088 family, the Stack Segment (SS) and Stack Pointer (SP) registers are most often used together and usually referenced as SS:SP.

The stack in the 8088 actually grows downward; that is, SP is smaller after a PUSH instruction is executed than before it. When a word is added to the stack, the SP register is first incremented by 2, and then the data being pushed is written to the new SS:SP.

A POP instruction performs the complementary function. Data at the current SS:SP is copied to the register or memory location specified by the POP, then the SP register is decremented by 2.

When an interrupt occurs in the PC, control is transferred to an interrupt han-

dlar. In order for processing to continue after the interrupt has ended, at least three values must be saved on the stack: the segment and offset of the instruction where execution is to be resumed, and the flags register. The IRET (return from interrupt) instruction replaces the flags with the saved values and resets the CS:IP registers to point to the next normal instruction.

Normally, setting a segment register will automatically disable the interrupts until the completion of the following instruction. Defective 8088s, however, can cause problems when an interrupt occurs in the middle of an instruction sequence such as this:

```
MOV SS,NEW_SEGMENT
MOV SP,NEW_OFFSET
```

Before these instructions execute, SS:SP points to a valid stack area. And after they execute, SS:SP will point to a new, valid stack area. But, if they are interrupted before both have been executed, the combination of the new SS and the old SP can point anywhere in the PC's memory! An interrupt will then cause PUSHed data to overwrite data or code at random. If the area destroyed happens to be part of DOS or a program you are executing, then the machine will probably hang and you will have to reboot.

Once the problem with the early 8088s became widely known, however, programmers developed a work-around. By specifically turning interrupts off prior to a stack change and reenabling them afterwards, disaster can be averted. Most experienced programmers will code the following from habit:

```
CLI ;Turn off interrupts
```

```
MOV SS,NEW_SEGMENT
MOV SP,NEW_OFFSET
```

```
STI ;Interrupts back on
```

In checking several popular programming references, however, I found no mention of this bug. It's safe to assume, therefore, that there are probably many programmers who do not know about it. How likely is it to have an interrupt in the middle of a stack switch? Probably not very. But the

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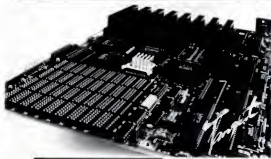
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■ PC TUTOR

PC can be considered an interrupt-intensive environment. Interrupts are generated by the clock, by disk drive operation, and when you press a key. For about \$15, switching chips can save a lot of grief.

Which chip to buy? It's largely a matter of preference, but I like the V-20. It draws less power, so it runs cooler. It also has extra hardware on the chip that makes some calculations run slightly faster.

EGA BORDER COLORS

How can I get border colors with my EGA monitor?

Nicholas Scariti
Yonkers, New York

The answers to many questions on the EGA were presented in Charles Petzold's now-classic Programming/Utilities column, "Exploring the EGA" (PC Magazine, Volume 5 Numbers 14 and 15). This comprehensive article describes programming the EGA's advanced features and gives dozens of examples.

I've reprinted the DEBUG script for one of Petzold's programs, EGABORD.COM, which you can use to set the EGA border color. First, make sure DEBUG is in your current directory or in a directory accessed by your PATH command. Then simply start DEBUG and type in the instructions exactly as shown in Figure 2. Be sure to include the blank line—just an <Enter>—after the INT 20. When you are done, you will have created the program EGABORD.COM.

To run the program, just enter

EGABORD xx

where xx is the two-digit octal code for an rgbRGB color and ranges from 00 to 77. For example, 40 is dim red.

```
N EGABORD.COM
A 100
MOV AX, {005D}
SUB AL, 30
CMP AH, 20
JZ 0113
SUB AH, 30
MOV CL, 03
SHL AL, CL
ADD AL, AH
MOV BH, AL
MOV AX, 1001
INT 10
INT 20
```

```
R CX
1C
W
Q
```

Figure 2: A program you can write in DEBUG to create EGA border colors.

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■ PC TUTOR

RUNNING HIDDEN FILES

The article "Changing DOS File Attributes" (Programming/Utilities, *PC Magazine*, Volume 5 Number 11) states that files with .COM, .EXE, or .BAT extensions can be run at the DOS level even

■ PC-DOS 3.3, the current version, adds a new command, APPEND, to find nonexecutable files.

when hidden. But my experience with all three file types resulted in the "Bad command or file name" error. Would you please clarify?

M. R. G. Appa Rao
Madras, India

Whoops! Although not mentioned in the article you referenced, the ability to execute hidden files didn't become available until DOS 3.0. From your letter, I would guess that you are running a 2.x version of DOS, which means that you will not be able to use this technique until you upgrade to a later version.

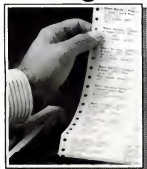
PC-DOS 3.3, the current version, adds new commands, such as APPEND (to find nonexecutable files in a path), and features, such as the ability to partition drives of more than 32 megabytes. It's worth the cost to upgrade and stay current.

Robert L. Hummel is senior technical editor of *PC Magazine*.

ASK THE PC TUTOR

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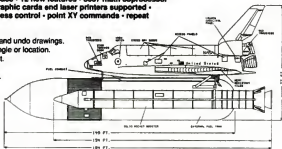
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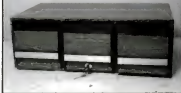
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CONNECTIVITY CLINIC



Are your programmers tying up both themselves and the network? Press a spare machine into service as a remote job processor. It will speed compiles and many other big batch jobs.

CREATING A COMPILE SERVER

PC-based LANs typically have a file server, they often have a print server, and sometimes they have a communications server. Univision now offers a database server for PC-based LANs, and Version 2.2 of NetWare should also have this capability. In this issue, a reader proposes a compile server for networks used in software development environments.

Several programmers use our Novell network for editing and compiling programs on their PCs. While the editing process is fast and efficient, compiling through the network slows down everyone. Additionally, the programmers are unproductive while their workstations are tied up compiling.

When we found a spare 8-MHz AT, I decided to use it as a remote job processor (RJP). This allows the programmers to do their compilations without tying up the network and lets them work on other tasks while their job is processed.

Since the RJP is a separate computer on the network, the submission of jobs is done through a common set of files. The RJP is

logged on to the network with sufficient rights to access the required files. In our case, it also uses the same default directory that the programmers use. While a special-purpose program to communicate from one computer to the other via network calls (like NETBIOS) may be more efficient, this system is portable to different network operating systems.

The system consists of three batch files and a delay program. RJ.BAT (Figure 1) is used to submit jobs for remote processing. RJSLOOK.BAT (Figure 2) runs continuously, searching for jobs pending. RJSECEC.BAT (Figure 3) is run by the RJP (RJSLOOK.BAT calls RJSJOB#.BAT, which calls RJSECEC.BAT) to actually execute the job. WAIT.COM doesn't perform any real work, but it halts everything to let remote batch processing take place.

To submit a job, type

RJ filename [username]

where *filename* is the name of the program to compile, and *username* is your optional network user name. RJ implements a queue of up to three pending jobs. If no

RJSJOB1.BAT exists, it creates the job by ECHOing the execution batch filename, user name, and the source filename (passed as parameters to RJ).

RJSJOB1.BAT then contains

RJSECEC filename username

The user is notified that the job was submitted. If a full queue of three jobs is waiting to be executed, a message to try again later (ending with a bell character) is displayed to the user. A three-job queue is usually adequate.

RJSLOOK.BAT is run continuously by the RJP to search for jobs pending. To start up the RJP, type RJSLOOK. It removes jobs from the queue in the same order that RJ.BAT enters them. If RJSJOB1.BAT exists, COMMAND.COM (using the /C parameter) is used to execute it. RJSJOB1.BAT actually calls RJSECEC.BAT to do the work. This is necessary since a batch file containing an I/O redirection character (>) can't be created via the ECHO command (I/O redirection is processed before the line is executed). Upon returning from COMMAND.COM,

```
ECHO OFF
REM RJ.BAT - SUBMIT A JOB TO THE REMOTE JOB PROCESSOR
ECHO .
IF EXIST RJSJOB1.BAT GOTO J2
ECHO RJSECEC %1 %2 > RJSJOB1.BAT
ECHO %1 has been submitted as RJSJOB1.BAT
IF NOT "%3" == "" ECHO %2 will be notified when job has completed
GOTO END
J2
IF EXIST RJSJOB2.BAT GOTO J3
ECHO RJSECEC %1 %2 > RJSJOB2.BAT
ECHO %1 has been submitted as RJSJOB2.BAT
```

```
IF NOT "%2" == "" ECHO %2 will be notified when job has completed
GOTO END
J3
IF EXIST RJSJOB3.BAT GOTO J4
ECHO RJSECEC %1 %2 > RJSJOB3.BAT
ECHO %1 has been submitted as RJSJOB3.BAT
IF NOT "%2" == "" ECHO %2 will be notified when job has completed
GOTO END
J4
ECHO Three jobs pending. %1 not submitted. Try again later.
END
```

Figure 1: RJ.BAT submits jobs such as compiles for remote processing.


```

TITLE WAIT.ASM
; This program may be used from a BATCH file to cause the system
; to wait the desired number of seconds. It displays a dot
; once each second.
;
; Usage: WAIT #
;       where # is 1-999 seconds
;
; macro from Microsoft MSDOS Programmer's ref Pg 1-252
convert_to_binary macro string, number, value
    local ten, start, calc, mult, no_mult
    jmp start
ten db 10
start:
    mov     value, 0
    xor     cx, cx
    mov     cl, number
    xor     si, si
calc:
    mov     ax, ax
    mov     al, string[si]
    sub     si, 10
    cmp     cx, 2
    jl      no_mult
    push    cx
    dec     si
    mult:
        mul     cx:ten
        loop    mult
        pop     cx
    no_mult:
        add     value, ax
        inc     si
        loop    calc
    ends

CHAR EQU 16      ; CHARACTER DISPLAYED WHILE WAITING
CR EQU 13         ; CARRIAGE RETURN
LF EQU 10         ; LINE FEED
CMD_STR EQU 800h ; OFFSET OF SIZE OF COMMAND STRING IS PEP
CMD_LINK EQU 82h ; OFFSET OF COMMAND STRING IS PEP

CODE SEGMENT PARA 'CODE'
ASSUME CS:CODE, DS:CODE, SS:CODE, ES:CODE

; .COM files start at 100h
ORG 100h
MAHF PROC FAR
BEGIN: JMP START

USE MDI DB "Usage: WAIT #", CR, LF, "n = seconds (1-999)", CR, LF, "S"
PARM1 DB 3 DUP (?)
;PARM2 DB 7
;PARM3 DB 7
LENGTH DB 0
COUNTER DB 0
TIME1 DB 0
TIME2 DB 0
SECONDS DB 0

START:
    LEA     DX, MSG ; SHOW NAME
    MOV     AX, 904
    INT     21h

    MOV     AX, CH2CMD_STR ; ANY PARM? 7
    CMP     AX, 1 ; IF SOME
    JZ      GET_TSS ; GET TSS
    ELSE, $MOV USAGE ; ELSE, $MOV USAGE

; MOVE THE PARAMETER STRING (LESS THE CARRIAGE RETURN) INTO PARM1
GETPARM1:
    SUB     AX, 1 ; DROP CARRIAGE RETURN
    MOV     SI, LENGTH, AX
    CLD
    ROR     CL, CX ; CLEAR CX
    ROR     CL, AX ; PUT COUNT IN CL
    PUSH    CX ; COPY CX
    POP     SI ; INTO SI
    LEA     SI, CS:CMD_LINK ; SET UP
    LEA     DI, ES:PARM1 ; POINTERS
    REP     MOVSB ; MOVE THE STRING

CONVERT_TO_BINARY PARM1, LENGTH, COUNTER ; GET IN BINARY
ADD     COUNTER, 1 ; INCREASE BY 1 SINCE THE
; FIRST CARRY INCREMENT
; WILL USUALLY BE LESS
; THAN ONE FULL SECOND

GETTIME:
    MOV     AX, 2CH ; GET THE TIME
    INT     21h
    CMP     DX, SECONDS ; SAME TIME AS BEFORE ?
    JZ      GET_TSS ; YES - TRY AGAIN
    MOV     SECONDS, DX ; NO - HAVE NEW TIME

    SUB     COUNTER, 1 ; DECREMENT COUNTER
    CMP     COUNTER, 0 ; TIME UP ?
    JE      DONE ; YES - QUIT

    MOV     AX, 2 ; DISPLAY
    MOV     DL, CHAR ; THE CHARACTER
    INT     21h
    JMP     GETTIME ; TRY AGAIN

USAGE:
    LEA     DX, USE_MSG ; SHOW USAGE
    MOV     AX, 904
    INT     21h

DONE:
    ROR     AX, AX ; ZERO AX
    MOV     DL, 4Ch ; GET OUT, RETURNING AX
    INT     21h ; DO IT

MAHF ENDP
CODE ENDS
END

```

Figure 4: Assembly language source code to produce WAIT.COM, which delays the execution of RJSLook.BAT for between 1 and 999 seconds.

cessed. If your network doesn't have a similar command, you may determine the job's status by typing

DIR filename.*

Once the job has been completed, the date and time of filename.ERR will be later than those of the original source file.

Garry Star
Los Angeles, California

Since compiling programs is not our

strong suit in the Connectivity Labs, we went to a company that uses networks to write programs for networks, DaVinci Systems in Raleigh, North Carolina. Its network application products include an electronic mail system running under Microsoft Windows and special projects for DEC, IBM, and the Federal Government.

The company ran Mr. Star's system and provided the following comments:

"In general, the idea of a remote job processor for local area networks is a very good one, and Mr. Star has provided users

with a simple implementation.

"These batch files need COMMAND.COM, so make sure the environment is set (with COMSPEC in AUTOEXEC.BAT or SHELL in CONFIG.SYS) so that it can be found.

"When you redirect the output of a compile, some messages are not redirected. For example, if a filename is submitted for compilation that does not exist, the output .ERR file will give no clue of it.

"It is possible to notify the users of errors in compiling by using the ERROR-

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LEVEL detection ability of DOS and sending the user an appropriate message if there was an error compiling.

*"Users should realize all their development must be done on a shared disk for this program to work. This means that an accidental DEL *.* could devastate every programmer, not just the one who typed it in.*

■ When development must be done on a shared disk, an accidental DEL *.* could devastate every programmer.

If you have enough disk space, try copying the source code from private virtual drives to the RJP drive.

"Mr. Star uses one unique Novell mail command. When using PC-Net software instead of NetWare, change the fourth line of RJSEXC.BAT to read

*IF NOT "83" == ** NET ERR 82 "81 JOB COMPLETED"*

"This takes advantage of PC-Net's command-line message transmission ability."

Mr. Star's idea is very useful. What other real-time or batch jobs are network processors doing for you?

Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

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HOW TO SUCCESSFULLY BUY THROUGH MAIL ORDER AND PROTECT YOUR RIGHTS

Mail order sales are governed by rules of the Federal Trade Commission (FTC) and various state laws. These guidelines are published as a service to you. Remember, the many vendors advertising in PC Magazine are eager to serve your needs.

FTC rules say:

1. The Seller must ship your order within 30 days of receiving it, unless the advertisement clearly states it'll take longer.
2. If it appears that your order will not be shipped when promised, the Seller must notify you in writing in advance of the promised date, giving a definite new date, if known, and offering you the opportunity to cancel the order with a refund or consent to a definite delayed shipping date or an indefinite delay.
3. The Seller's notice must contain a stamped self-addressed card or envelope with which you can indicate your preference. If you don't respond to this notice, the Seller may assume you agree to the delay, but must either ship or cancel your order within 30 days after the original

shipping date promised or required. A prompt refund must be made when an order is cancelled.

4. Even if you've consented to an indefinite delay, you retain the right to cancel the order at any time before the item has been shipped.
5. If you choose to cancel an order, that has been paid for by check or money order, the Seller must mail you a refund within seven business days. If you cancel an order for which you paid by credit card, the seller must credit your account within one billing cycle following receipt of your request. Store credits or vouchers in place of a refund are not acceptable.
6. In the event that the item you ordered is unavailable, the Seller may not send you substitute merchandise without your express consent.

TIPS WHEN ORDERING

When ordering by mail:

State precisely what merchandise you want, specifying details such as model, make, size, component parts, etc.;

Confirm the price and expected delivery date as stated in the ad;

Indicate whether you will accept a substitute product if the item you ordered is unavailable, and, if not, that your payment should be returned;

Don't send cash, you will have no record of payment if a problem arises, and;

Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order; and any sales slips and shipping receipts.

When ordering by phone:

Note the time and date of your conversation and the name of the person you talk with;

Make a record of your order, the price, its promised availability and the components to be expected;

Save all correspondence associated with your order, including your cancelled check or a copy of the money order, and any written confirmation sent by the Seller.

Questions you should consider asking:

Does the advertised item come with all necessary parts and accessories? Are they from the same manufacturer? Is it available for immediate shipping? If not, when will

it be available?

Has there been an increase in the advertised price?

What warranties does the item carry? Who provides the service?

What is the Seller's return policy?

What is the Seller's refund policy?

With whom should you correspond if there is a problem?

IF YOU HAVE PROBLEMS:

1. If you have not received your order as promised or if the item is defective, immediately notify the Seller in writing referring to your order by description, price, date, as well as by account number and order number, if available. Make sure you keep a copy of the letter.
2. If you complain by telephone, send a follow-up letter to confirm what was said.
3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.
4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.
5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

PC Magazine's Direct Marketing Connection

For PC Products and Services

For many of you, mail order is your primary means of purchasing PC products and services.

In fact, in recent interviews with our subscribers, we learned that 70% bought PC products and services through direct marketing channels during the past year.*

You buy direct because it's convenient, because you know exactly what you want and don't need any hand-holding.



The following special section, PC Magazine's Direct Marketing Connection, is what you've been demanding. It connects you with the direct marketers who are anxious to please you. By having them all in one place, you can quickly zero in on the products you need from the vendors you want to buy through.

*Starch Study, July 1986



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Super Twist Screen..... 1499	EL Screen..... 1569
★ NEW Multispeed HD with 20MB	2599 ★
DICONIX 150 Pwr w/3" custom cable	319
With Any Laptop Computer	290
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Optima with Laptop	99/80
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Symphony 3.5" with Laptop	449/420

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PC4501	829
PC4502	1199

★ TOSHIBA ★

T1000..... 799	T3120..... 2999
T3120 with out LOTUS software	2669
Toshiba 1200 Int Modem with Laptop	329/300
World Port 1200/2400 Ext with Laptop	140/280
Toshiba Ext 5.25" Floppy with Laptop	379/350
Toshiba Floppy Laptop with Laptop	169/150
T3100 Numeric Keypad with Laptop	90/80
T1100 + Auto Pwr Adapter	50

★ SEAGATE HARD DRIVES ★

STARTER KIT: PC XT 1/2 Ht 20/30 MB	279/299
1" FOR AT + With PARTITION SOFTWARE	49
40 MB Half Ht..... 399	80 MB Full Ht..... 799

★ PLUS HARD CARD 20/40... 525/775 ★ TOSHIBA 321SL/341SL... 479/599 ★

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ALQ 200 Tractor	1.2 Mb Ht (AT)	With Vega Deluxe	GENOA SuperEGA HiRes
★ ALQ 300 Color	Grey Face Plate - Add.	★ AUM-1371 Diamond Star	With Multi Scan Monitor
16 pin, 200/100 cps	5	With Genos HiRes	LOGITECH EGA Card & Mouse
24 pin, 240/120 cps	★ MINISCRIIBE ★	With Paradise 480	With Multi Scan Monitor
ALQ 300 Tractor	20 Mb Int 1/2 Ht w/Cont	With Paradise VGA Plus	NEC Multisync GB-1
★ P2000 9 pin, 250/125 cps, Wide	30 Mb Int 1/2 Ht w/Cont	With Vega Deluxe	With Multi Scan Monitor
Ser & Pwr w/Tractor	40/70 Mb Full Ht (AT)	With Video-7 VGA	PARADISE AutoSwitch 480
★ P2100 18 pin, 490/200 cps, Wide	★ PLUS HARD CARD ★	★ NEC Multisync 1401	With Multi Scan Monitor
Ser & Pwr w/Tractor	★ LIMITED TIME OFFER ★	With Genos HiRes	TAXAM 557 Gold Card
★ P2400 Color, Wide w/Tractor	★ 20 MB single slot	With Paradise VGA Plus	With Taxon 630/650
16 pin, 250/125 cps	★ 40 MB single slot	With Video-7 VGA	Taxam 570 Advance EGA: same as
24 pin, 360/180 cps	★ SEAGATE ★	★ NEC Multisync 1401	GENOA SUPER EGA
ALPS Buffer Kits, Fonts, Tractors	★ For PC/XT HALF HT ★	With Genos HiRes	With Multi Scan Monitor
Sheet Feeds, Ribbons & 18 pin/24 pin	★ STARTER KIT 20/30 MB 179/299	With Paradise VGA Plus	VIDEO-7 Vega Deluxe
upgrade kits	Fully Trained STARTER Kit	With Video-7 VGA	With Multi Scan Monitor
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- NO CONTROL FOR WHAT OTHERS CALL A FLOPPY CONTROLLER
- SUPPORTS 16 DRIVE SIZES INCLUDING 5, 10, 20, 30 & 40 MB
- DIVIDE 1 LARGE DRIVE INTO 2 SMALLER, LOGICAL DRIVES

MCT-FDC-1.2 1.2MB FLOPPY CONTROLLER \$89⁹⁵

- ADD VERSATILITY & CAPACITY TO YOUR AT
- SUPPORTS 2 DRIVES, BOTH MAY BE 360K OR 1.2 MEG
- EX PANDABLE DATA TO FLOW FREELY FROM THE AT

MCT-FH FLOPPY/HARD CONTROLLER \$139⁹⁵

- 3 1/2" HD DRIVE FOR 5.25" SATELLITE WITH THIS TRIPLE DESIGN
- INTERFACES UP TO 2 FDDs & 2 HDDs, CARLING FOR 2 FDDs & 1 HDD
- SUPPORTS BOTH DS-DD & DS-GD WITH DOS 3.3

MCT-ATHH AT FLOPPY/HARD CONTROLLER \$149⁹⁵

- FLOPPY/HARD DISK CONTROL IN A TRUE AT DESIGN
- SUPPORTS UP TO 2 360K/720K, 1.2MB FDDs
- AS WELL AS 2 HDDs USING STANDARD CONTROL TABLES



1/2 HEIGHT HARD DISK DRIVES

40 MB \$469
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Drives are Seagate models ST-25T (40 MB) & ST-27T (60 MB RLL) 5 1/4" half heights

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Systems include Seagate 1/2 height hard drive,

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FROM MODULAR CIRCUIT TECHNOLOGY

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- 4.77 OR 5 MHz OPERATION WITH 8086-2 & OPTIONAL 8087-3 CD PROCESSOR
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- 8 SLOT (2 EIGHT BIT, 6 SIXTEEN BIT) AT MOTHERBOARD
- HARDWARE SELECTION OF 5 OR 8 MHz
- 16 MB STATE
- KEYLOCK SUPPORTED, RESET SWITCH, FRONT PANEL LED INDICATOR
- SOCKETS FOR 1 MB OF RAM AND 80287

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- OPERATES AT 5, 10 MHz UP TO TIME ON-BOARD MEMORY (8087 K INSTALLED)
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JE1015	XT/AT Style Keyboard	\$ 59.95
JE1030	150 Watt Power Supply	\$ 69.95
JE1020	5¼" DSDD Disk Drive	\$ 89.95
AMBER	12" Monochrome Amber Monitor	\$109.95
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SAVE \$70.70

Regular List \$670.65

JE1005 Turbo IBM PC/XT Compatible Kit... \$599.95



4.77/8MHz Turbo!

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NEW!

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with MonoGraphics card & Tilt/Swivel Mono Monitor
with Paradise 480 card & NEC MultiSync Monitor

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The real thing: Intel 80386-16 CPU with 80387 Coprocessor, Intel 512K motherboard with two 8-bit slots, four 16 bit, and two 32 bit slots. Phoenix BIOS 220 watt power supply Serial & Parallel ports. 88 key "AT" or 101 key "RT" keyboard. 1.2 Mb floppy drive. Western Digital FloppyHard Disk Controller. 1 Year Warranty.

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- Short Slot size
- 300 or 1200 bps speed
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- Line-busy detect and auto redial
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- Plugs into Floppy controller in PC or AT
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- Up to 42 MB per cartridge
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AT hard disk kits

- Includes AT mounting rafa, & data cable
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Size	Model	Speed	Capacity	Price
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FH	Seagate ST4053	28ms	44.5MB	\$599
FH	Seagate ST4096	28ms	80.2MB	\$888
FH	MiniScribe 6053	28ms	44.6MB	\$619
FH	MiniScribe 6085	28ms	44.6MB	\$688
FH	Microplot 1335	28ms	71.3MB	\$899
FH	Prism 519	20ms	71MB	\$2295
FH	Maxtor 1140	27ms	117MB	\$2295
FH	Prism 519/Award	20ms	159MB	\$2395

768K mini EMS \$179



- 768K of 120ns RAM
- Lotus/IntelliMicroSoft compatible
- Can backfill to 640K, remainder as EMS
- Short slot card
- 1 MB piggyback board option \$169
- Pop-up window print spooler, and RAM disk software

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a full-length, XT height, expansion card that occupies a single slot. It plugs into your phone line with a standard RJ11 phone jack. You can also plug in a telephone so you won't lose a phone line



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Requirements: PC compatible with 512K RAM, DOS 3.0 or later, hard disk drive, & graphics adapter.

FAX/96 includes: Full-length circuit board, PC/MS-DOS compatible software, phone cord, 1 year warranty, 30 day money back guarantee

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- NEC V20, 4.77 or 8 Mhz Speed
- Phoenix BIOS, Norton SI 31
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- 360K Floppy, Serial, Parallel, & Game Ports
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with MonoGraphics card & TitanWivel Mono Monitor \$699
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\$399

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- Requires 1 1/2 slots
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RLL HARD DRIVE ENCODING, 1:1 INTERLEAVING AND 2.5 TIMES FASTER DATA TRANSFER CONTROLLER = LIGHTNING FAST COMPUTING PERFORMANCE AT A PRICE OTHER COMPUTER VENDORS CAN'T MATCH!

If you're a first-time computer shopper, looking at all this technology is probably plenty confused. BUT, YOU KNOW YOU JUST CAN'T BUY A FULL AT SYSTEM FOR \$995.00 OR AN XT FOR \$349.00 AS OTHERS ADVERTISE. THAT'S LIKE A CAR WITHOUT WHEELS.

Don't be misled by the confusing "bare bones" or "basic system" pricing others use just to appear competitive. By the time you add up everything else you need, you'll end up paying more and probably getting just an **ordinary performance machine**. Knowledgeable computer buyers know that Northgate offers **Complete Systems that are truly different from the rest of the pack**. That's why **Computer Shopper** named Northgate's 286 as the 1987 **BEST BUY IN COMPUTING**. Now, Northgate's innovative design skills have created "E/T" Enhanced Technology Systems with even better performance and value.

Our proven method of RLL encoding superb MiniScribe hard drives gives you 50% more hard drive storage for your money. A 1:1 interleave is applied to the drives. This delivers data from the disk to the read-write heads 300 to 600% faster than the drive/controller combination most other competitors provide.

Northgate uses an OEM hard drive controller with data transfer rates up to four times faster than most competition.

The result is a true Power System with overall system performance at least 2.5 times that of systems using ordinary, off-the-shelf parts.

Northgate has developed a thoroughly reliable method of using RLL encoding on the hard drives in all our 286 "E/T" systems. In 80286 systems, this technology is unknown to most of our competitors. Call them! You'll be amazed to find almost none offer RLL drives in 286 systems. Some will even tell you it can't be done. Next, ask about vital through-put factors like controller data transfer rates and interleaving ratios.

Most competitors merely assemble a collection of parts so archaic as to actually degrade performance. The Drive/Controller combinations most others use have the effect of **harnessing a race horse to a plow**. Processor speed is wasted because controller transfer time is so agonizingly slow.



Northgate takes the confusion, uncertainty and guesswork out of buying your computer. Skillfully assembled, thoroughly tested, your Northgate system arrives fully configured, ready to plug together and use. And Northgate has designed the most thorough, easy-to-follow documentation that takes novice or professional from set-up to shut down. **WRITTEN IN ENGLISH!**

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Add to all these features, the most meaningful Consumer Protection Policies in the computer industry (see next page).

So forget competition's bare bones prices and those just ordinary systems...

COMPARISON WILL PROVE NORTHGATE OFFERS MORE!

STANDARD NORTHGATE SUPER/TURBO 286-60 "E/T" SPECIFICATIONS:

PROCESSOR	INTEL 80286
PROCESSOR SPEED	8/12 MHz 1 WAIT
MAKE OF BIOS	AWARD WSETUP
EXPANSION SLOTS	IN ROM
STANDARD MOTHERBOARD MEMORY	8 (TWO 8 BIT, SIX 16 BIT)
CO-PROCESSOR SLOT	1 MEGABYTE
CLOCK-CALENDAR	120NS
NO. OF FLOPPY DRIVES	YES
NOTE: 3 EXPANDED HALF HEIGHT DEVICES MAY BE INSTALLED	YES WITH AA BATTERIES
BRAND OF FLOPPY	2—1.2MB and 360K
NO. OF HARD DRIVES	1 (SPACE FOR TWO)
TYPE OF HARD DRIVE	MINISCRIBE
HARD DRIVE FORMATTED	MODEL 3650
STD. MONITOR TYPE	64.2 MEGABYTES
STD. VIDEO CONTROLLER	USABLE
ADDITIONAL PORTS STANDARD	SAMSUNG 12"
KEYBOARD TYPE	AMBER TTL
MS-DOS 3.2 & GWBASIC	HERCULES
CASE—FULL SIZE (NOT BABY AT)	COMPAT. 1 P.P.
	1 P.P. 1 S.P. 1 G.P.
	ENHANCED IOI
	CLICK TYPE
	WITH HARD COVER
	MANUALS
	HAS CONTROL
	PANEL, LED'S AND
	SECURITY KEYLOCK

SUPER/TURBO 286-60 "E/T" SYSTEM PRICE COMPLETE \$1999.00

WITH ALL FEATURES ABOVE AND MINISCRIBE 32 MEGABYTE RLL HARD DRIVE SUPER/TURBO 286-60 "E/T" ... **\$1899.00**

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AND FOR THE BEST BUY IN XTURBO "E/T" SYSTEMS...TURN THE PAGE

Northgate's V20/8MHz XTurbo Is Now Available with 65MB Hard Drive and the same "Enhanced Technology"



NOW...for the buyer who doesn't need 286 speed but wants an XT type system with through-put up to four times faster than other systems, Northgate offers its XTurbo/V20/8-65.

This system also features the MiniScribe hard drive and SMS high speed controller. It is furnished complete with:

V20 Microprocessor • 640K Memory on Motherboard • 360K Floppy Drive • MiniScribe 60MB FAST Hard Drive with 1:1 Interleave • 8 Expansion Slots • 2 Parallel, 1 Serial Port, Clock-Calender, Game Port • Amber Screen TTL Graphic Monitor with Hercules Compatible Video Card • Northgate "C/T" Click-Tactile 84-key AT style keyboard • Case is the AT style with turbo button, keylock reset button and indicator lights. (Second Floppy Drive pictured is optional at additional cost.)

Complete System Price: \$1299⁰⁰

Same system with 30MB Hard Drive ⁸1149⁰⁰

NORTHGATE GIVES YOU THE MOST POWERFUL CONSUMER PROTECTION WARRANTY IN THE COMPUTER INDUSTRY...

30-Day Compatibility Warranty:

Northgate guarantees its systems will operate any standard, commercially available DOS programs written for use on IBM Compatible Computers. If, on consultation with Northgate, a program cannot be made to operate satisfactorily, owner may return the system, complete and unaltered for a prompt and full refund including all freight costs.

One-Year Overnight AT NORTHGATE EXPENSE Parts Replacement Warranty:

Northgate Computer Systems warrants that all systems sold by Northgate will be free of defects in workmanship and materials for one year from date of shipment.

In the event of failure of a part that disables the system Northgate will ship, the same day if notified by 12 Noon Central Time, a new replacement part. Customer must phone Northgate Customer Service for diagnosis of the failure.

Shipment of the replacement part will be by overnight express service—AT NORTHGATE'S EXPENSE—for next day delivery depending on the carrier's ability to provide such service in owner's geographic area.

Owner must return any replaced part, complete and unaltered, and pay return shipping costs, to be received at Northgate within two weeks after receiving the replacement part.

Northgate's Customer Service department will provide full instructions on making the repair or replacement and will consult with customer on the phone to assure repair is properly completed and the system is again operating.

In the case of a complete system returned for repair under warranty, customer pays freight to Northgate and Northgate pays return freight by whatever service the system is sent to Northgate.

In the event of a part replaced under warranty, the new part carries a NEW ONE-YEAR GUARANTEE FROM SHIP DATE!

NOTE: Many computer vendors extend only the parts manufacturer's warranty which may be as little as 30-days. All products sold by Northgate are fully guaranteed by Northgate for one year from date of shipment.

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ENHANCED 101-KEY MODEL C/T 101:

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THE TOUCH, THE SOUND, THE FEEL OF A SELECTRIC TYPEWRITER. YOU CAN GET IT NOW! INTRODUCING THE NORTHGATE "C/T" (Click-Tactile)

You're reading this ad because your current keyboard leaves a lot to be desired. IBM set the standard with the original PC Keyboard. And nothing else came close - UNTIL NOW!

LOW QUALITY CLONE KEYBOARDS EQUAL LOW COST CLONES...

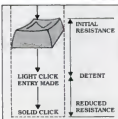
Why are most clone keyboards so lacking? Because clone makers buy low cost keyboards to keep system costs down. The majority come from three manufacturers - KeyTronics, Mod-Switch and BTC. All have a rubber-like membrane beneath the keys. That's why they feel spongy. No sound, no sensation. Just a mushy feel and a distant "thunk" as the key hits bottom.

We searched the world three years to find the ideal keyboard. With the feel, sound and touch of an electric typewriter. Whose keys give a solid, positive entry WE FOUND IT! And now it's standard with all Northgate XTurbo and ATurbo Systems.

OUR CUSTOMERS TOLD US "SELL THESE KEYBOARDS" TO EVERYONE!

To our delight, buyers of our systems* began buying our "C/T" keyboards to replace those they purchased before they discovered Northgate quality and value. It was these customers who suggested we offer the new "C/T" Keyboard to all PC users looking for a better keyboard.

*Ask about the New Northgate ATurbo—a Complete 10MB+ 40MB Hard Drive System \$1999.00



TRY THE NORTHGATE "C/T"... YOU'LL FEEL THE DIFFERENCE.

Plug the Northgate "C/T" into your system. Press a key. WOW! At first touch you know this is it! At first passes detent at center position with a slightly audible "click." Sound and change in tension tells your fingers you've made an entry. As the key bottoms, a more positive click confirms the entry and signals the finger to release and hit another key. Touch typists love it.



New sculptured profile design

In actual typing tests, speed increased by up to 28 percent with a 16 to 20 percent reduction in errors. Besides making typing enjoyable again, the increases in production you will get with the "C/T" should be enough reason to replace all your keyboards!

Enhanced 101-key Model

ONLY \$99.00

(Compatible with XT or AT)

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205
195
205
385
285
409
335
1269
679

OTHER HARDWARE

195 Amtek Laserdrive I
205 Panasonic Scanner
385 Summagraphics Plus
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SOFTWARE

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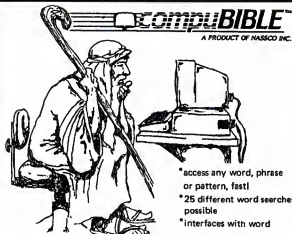
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Software Expert Reveals The Truth About How He “Remembers” 1,017 Program Commands

It's overwhelming. By actual count there are 1,017 commands to remember.

That's because I use several different software packages in my business. (You probably do too.) In all there are 1,017 commands I may have to recall to get my work done efficiently.

Wouldn't it be fantastic to instantly recall any command you or I needed? With ease? Without digging through manuals?

Good Memory But...

Now I have a good memory. But not for things like "Alt-F8." I just can't seem to remember that it means "Page Format" in WordPerfect. And I'm no beginner.

Since 1968 I've been working with computers and software, and I still get frustrated by the complexity of these bit-brained boxes. And their so-called "user friendly" software. The programs I use are about as "friendly" as a rattlesnake.

So I invented something to make my life (and yours) easier.

Needed a Simple Solution

I needed a simple solution to the problem of remembering cryptic software commands, so I designed PC-DecuRef, a combination keyboard "template" and reference booklet. This handy unit attaches to any keyboard. On it, the commands for a given program are concisely defined and meticulously organized.

You see, since 1982 my company has made keyboard templates for most popular software and keyboards. These quick-reference guides, called PC-DocuMates, are "bestsellers" with over 600,000 in use, and have become a "classic"

But today, software is much more elaborate and there are about 100 different keyboard styles. I saw the need for a universal reference aid that would fit any computer, even laptops and portables. And provide more information for complex software than is possible on a template. Our classic templates fit 5 different keyboard styles, and they are still a great solution. But as you can see from the picture here, PC-DoctRef is designed for any keyboard.

Special panels slide out from the booklet base giving you the convenience of a template. Then the booklet gives you comprehensive reference at a flip of the tabbed pages. And it's made from a unique plastic material which won't fade, tear, or get dog eared with use.

Convenient and Easy to Use

Because it attaches snugly to the top of the keyboard and puts needed information at your fingertips, PC-DocuRef is easy to use and truly convenient. No searching for reference cards or booklets which get lost or torn up. No digging through manuals, either.

PC-DocuRef just sits handily on your keyboard, held in place by velcro tabs on the back. To remove it you just lift it off. So when you shift from your favorite word processor to your spreadsheet, you can just slip the next **PC-DocuRef** on. And it's simple to use because of the unique design.

Functionally Organized for

The commands are organized by the function you want to perform, like DELETE or FIND or SAVE. You can find the command you want about 20 to 30 times faster than looking in the manual.

Each function is defined by a color-coded heading or tab, which makes finding the command you need quick and easy. We use color-coding consistent with the software manufacturer's documentation. This makes key combinations easy to understand and remember. Function key commands are specified on a separate color-coded template (for IBM "Enhanced" style keyboards) and also on the left slide-out template.

Obvious Benefits

Obvious Benefits
The outstanding benefit of PC-DocuRef is that it helps you get your work done faster and easier. Personally, I get a 15% to 20% improvement in



Software expert Jack Segner, designer of memory-saving PC-Docufiel™ and PC-Docufate™



PC-Docuflet™ provides a simple solution to the problem of mastering complex software

my productivity on familiar software and even greater improvement on less often used packages. That means I can save up to an hour a day, just by using my PC-DocuRefs.

Surprising Benefits

But there are some surprising other benefits. The concise summary of the commands seems to simplify the entire software package. I find it increases my confidence in using a complex program.

It's easy to try new features and extend your skill and competence when everything you need is neatly summarized right on your keyboard.

And when you don't use a package every day **PC-DocuRef** is like a quick "refresher" course each time you sit down at the keyboard. But there's a bonus benefit.

Will Never Be Obsolete

When you own a PC-DocuRef, and register it with us, you can get updates. It never becomes obsolete. When you upgrade to a new version of a software package, you can inexpensively upgrade your PC-DocuRef. This privilege lasts for as long as you own your PC-DocuRef.

But Still Not Perfect

As efficient and helpful as PC-DocuRef is, it's still not perfect. The commands are fully summarized, but sometimes you will need more detail from a software manual. However, for most commands you use, PC-DocuRef is all you ever need for reference.

Who Needs a PC-DocuRef?

I really need PC-DocumeRef to help me remember. It's easy to forget what "F3" and "Alt-B" and "Shift-F7" mean in six different programs, when you have more important things on your mind. Business and professional people are busy using the computer to get work done. We don't need to clutter our brains with arbitrary commands like "Ctrl-F2." So if you want to get the most from your computer, without memorizing thousands of commands, you need PC-DocumeRef.

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Jack Agner

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DISKETTES	539, 540
EXPANSION UNITS	540, 541
MONITORS	
PERIPHERALS	541
PLOTTERS	542
POWER PROTECTION	
POWER SUPPLIES	542
PRINTERS	
SECURITY	542
SPEED DEVICES	542

SOFTWARE

ACCOUNTING	542, 543
ARTIFICIAL INTELLIGENCE	543
BACKUP SYSTEMS	544
BUSINESS	544, 545
BUSINESS PROJECT MANAGEMENT	545

SOFTWARE *continued*

BUSINESS TIME MANAGEMENT	545
COMMUNICATIONS	545
CONSTRUCTION	545
DATA BASE	545
DATA ENTRY	546
DATA MANAGEMENT	
DESKTOP PUBLISHING	546
DEVELOPMENT TOOLS	
... (See Programmers Tools)	
EDUCATION	546
ENGINEERING	547
ENTERTAINMENT/GAMES	547, 548
FINANCIAL	548, 549
GENERAL	549, 550
GRAPHICS	550
HEALTH	551
INVENTORY	551
LANGUAGES	551
LEGAL	551
MAILING PROGRAMS	551
MANUFACTURING	551
MEDICAL	551, 552

SOFTWARE *continued*

MULTI-USER SYSTEMS	
MUSIC	552
ONE-OF-A-KIND	552
OPERATION SYSTEMS	552
PREVENTATIVE MAINTENANCE	553
PROGRAMMERS TOOLS	553, 554
PUBLIC DOMAIN	554
REAL ESTATE	554
RELIGION	554-555
SALES MARKETING	555
SCIENTIFIC	555
SECURITY	555
SERVICES	
SHAREWARE	555
STATISTICS	556
TAXES	556
TERMINAL EMULATION	556
TRAINING	556
TRAVEL	
UTILITIES	556, 557, 558, 559
WORD PROCESSING	559, 560

MISCELLANEOUS

ACCESSORIES	560
BAR CODING	560, 561
BOOKS	561
BUSINESS OPPORTUNITIES	561
CATALOGUES	561
COMPUTER INSURANCE	561
COMPUTER LEASING	
COMPUTER SERVICES	
COMPUTER TRAINING	561
CONSULTANTS	
CONVERSION SERVICE	
DATA CONVERSION	561, 562
DIGITIZERS	
DISK CONVERSION	562
DISKETTE COPY SERVICE	562
EMPLOYMENT OPPORTUNITIES	
FURNITURE	
MAILING LISTS	562
NETWORKING	563
PUBLICATIONS	
SUPPLIES	563
USED EQUIPMENT	

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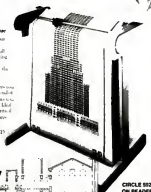
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EDITORIAL PRODUCT INDEX

READER SERVICE NUMBER	PRODUCT	COMPANY	PAGE	READER SERVICE NUMBER	PRODUCT	COMPANY	PAGE	READER SERVICE NUMBER	PRODUCT	COMPANY	PAGE
ACCOUNTING				638	dMPL Reporter	Database Applications Inc.	357	658	Seagate ST4038	Lifetime Memory Products	266
682	SouthWare Business Series	SouthWare Innovations Inc.	343	637	FermManager II	BIT Software Inc.	360	657	Seagate ST4038	PC Connection	268
ADD-IN BOARDS				636	Intelligent Duty	Programmed Intelligence Corp.	362	656	Seagate ST4038	PC Designs	278
422	Awesome I D Card	CS&L Inc.	56	635	PC Focus dBASE Interface	Information Builders Inc.	364	653	Seagate ST4038	Priority I Electronics	262
434	IDEAnia MC	IDEAssociates Inc.	52	634	Quickreport for dBASE	Fox & Keller	366	657	Soft TurboDrive	DataZone Services	269
426	Paradise VGA Professional Card	Paradise Systems Inc.	53	632	RAMIS PC Workstation	On-Line Software International Inc.	367	676	Soft UltraDrive 47	DataZone Services	269
AFTER HOURS				633	R&R Relational Report Writer	Concentric Data Systems Inc.	369	668	Standard Brand Flash Card-20	Standard Brand Products	226
688	Build Yourself a Generic Computer. Featuring Mark Wilson	Meckler Video	316	631	Reports Plus	Softsync Inc.	371	667	Standard Brand Flash Card-32	Standard Brand Products	226
681	CDA	The Source	578	630	Snow Report Writer	Snow Software	374	665	THE 20-MB Hard Disk Card	Thompson, Hamman, and Edwards Computer Products Ltd.	232
686	Micro Kitchen Manager	Concept Development Associates Inc.	572	HARDWARE				664	Western Digital FreeCard 30	Western Digital Corp.	234
669	Nematus Master	The Go	576	432	Futura Domain MCS-350	Futura Domain Corp.	52	PRINTERS			
680	Personal Ancestral File R.S.V.P.	Distribution Center	576	429	PC Viewer - 2	In Focus Systems Inc.	52	431	RuggedWriter 480	Hewlett-Packard Inc.	53
685	StudyMate	Jackson Software	572	441	QuickBASIC 4.0	Microsoft Corp.	33	SOFTWARE FONTS			
CAD				LANGUAGES				429	Display Font Pack	SoftCraft Inc.	53
681	AutoCAD	Autodesk Inc.	101	441	QuickBASIC 4.0	Microsoft Corp.	33	421	Fontware Installation Kit for Microsoft Windows	Fontware Inc.	43
683	AutoSketch	Autodesk Inc.	109	678	CMS Drive Plus 40	CMS Enhancements Inc.	206	420	Fontware Installation Kit for Ventura Publisher	Fontware Inc.	43
651	Cadkey I	Micro Control Systems Inc.	122	435	Double Play	Redline Inc.	38	436	The Soft Font Manager	Human Touch Software	46
679	CAMM-3	Roland DG	188	670	Gold-Card 21	Silicon Valley Computer	225	SPREADSHEET ANALYSIS			
652	CDS Designer	Computer Computer Services Inc.	127	669	Gold-Card 50	Silicon Valley Computer	225	423	O A V E	Goldata Computer Services	48
649	Curve Digitizer	West Coast Consultants	138	674	Maynard Onboard 30	Mountain Computer Inc.	212	424	Depl	PC Publishing Inc.	48
684	Drafix 1 Plus	Forefront Resources Corp.	141	675	Mountain Computer DriveCard 50	Mountain Computer Inc.	212	440	Quattro	Borland International	33
642	Drafix 30 Modeler	Mega CAD	146	673	Plus Development HardCard 20	Plus Development Corp.	214	UTILITIES			
650	EasyCAD	Evolution Computing	151	672	Plus Development HardCard 40	Plus Development Corp.	214	426	Beyond BAT	VM Personal Computing	56
647	ECAD Drafting Software	Person Engineering Ltd.	154	671	Redline R-Card 45	Redline Inc.	216	438	Funk and Wagnall's Standard Desk Dictionary	Intracel	46
648	EnrekCAD	EnrekCAD Scientific Corp.	162	666	ScoreCard 47	Systems Peripherals Consultants	230	425	The Norton Guides	Peter Norton Computing	56
645	EnrekCAD	EnrekCAD Scientific Corp.	162	660	Seagate ST225	47th Street Computer	254	WORD PROCESSING			
640	In*in*Vision	Micrografx Inc.	169	660	Seagate ST225	Lifetime Memory Products	266	694	Microsoft Word	Microsoft Corp.	289
643	LaserCAD	OSL Inc.	174	658	Seagate ST225	PC Connection	268				
645	MATCAD	MATCAD	178	656	Seagate ST225	PC Designs	278				
640	MicroModeler	Roland DG	188	654	Seagate ST225	Priority I Electronics	282				
641	ProDesign II	American Small Business Computers	184	651	Seagate ST4038	47th Street Computer	254				
643	Pro3D PC	Enabling Technologies Inc.	188	PRODUCTIVITY							
644	TurboCAD	NSA Group Inc.	196	DEPARTMENT				PROGRAM NAME DESCRIPTION			
COMMUNICATIONS				PC Lab Notes							
437	Instant Yellow Page Service	American Business Lists Inc.	46	Utilities							
COMPUTERS				Environments							
698	Acer 710	Acer Technologies Corp.	323	Power Programming							
699	Cordata WPC	Cordata Technologies Inc.	324	Spreadsheet Clinic							
697	IBM PS 2 Model 25	IBM Corp.	326	Spreadsheet Clinic							
693	Olivar Technologies	Olivar Technologies	52	User-to-User							
696	Vendex Turbo-888-XI	Vendex Pacific Inc.	332	User-to-User							
695	Zenith only pc	Zenith Data Systems	336	Power User							
CONNECTIVITY				Power User							
693	cc Mail LAN Package	PC Systems Inc.	304	Power User							
693	EtherLink MC	3Com Corp.	52	Power User							
692	Network Courier Inter-Net Version	Consumers Software Inc.	312	Power User							
DATABASE MANAGEMENT				Power User							
639	Alpha three	Alpha Software Corp.	354	Power User							

COMING UP

NEW WINDOWS APPLICATIONS

Application programs designed for the Windows environment are increasing the status of the graphics interface in the starched-shirt world of MS-DOS. West Coast editor Jared Taylor looks at *Excel*, a spreadsheet sure to challenge 1-2-3; Mike Falkner examines *Quartz*, Blyth Software's new database for the PC; and executive editor Bill Howard takes a look at a graphics package, Micrografix's *Windows Graph*.

LIQUID CRYSTAL IMAGING FOR OVERHEAD PROJECTORS

The technology that brought us LCD watches has joined with overhead projectors to put presentations on big screens in auditoriums. Frank Bican reviews ten LCD palettes for overhead projectors.

LIKE A STRING AROUND YOUR FINGER

TSR note-taking programs can pop up helpful reminders without forcing you to leave your application. Staff editors Catherine D. Miller and Jonathan Matzkin review note-takers for all occasions, like *Tornado* and *MemoryMate*, as well as those designed for use with 1-2-3, like *Cell Noter*, *Note-It Plus*, *Noteworthy*, and *SmartNotes*.

SOFTWARE FOR THE TELEMAR-KETER

Need to keep a database of your clients, call sheets, and account activity? Henry Fersko-Weiss reviews five programs designed to help you track your sales accounts: Excalibur Sources' *Exsell*, Arlington Software+Systems' *PCAT*, Software of the Future's *SaleMaker*, Stadis Corp.'s *SpaceBase*, and Travis Data-Trak's *TelePro PC*.

PLOTTERS Despite advancing printer technology that challenges the low end of the plotter market, plotters continue to sell well. Contributing editor Glenn A. Hart benchmark-tests eight new plotters, including the Hitachi 672-XD, 673, and 675; the Houston Instrument DMP-61; Optical Computer's OCI 928; the Western Graphtec PD9111; the Mutoh IP-500A; and the Enter Computer SP1000.

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INDEX TO ADVERTISERS

RS #	ADVERTISERS	PAGE	RS #	ADVERTISERS	PAGE	RS #	ADVERTISERS	PAGE	RS #	ADVERTISERS	PAGE
198	3Com	448	291	Data World	147	224	Microspan Technology	177	*	Quint	474
199	786 Computer	66-81	292	Data World	157	254	Muth Soft Inc	42	325-334	Quireck	475
200	Access A/F	383	293	Day	234	255	Obio	231	335	Quireck	476
201	Access Micro	389	351	DCA	82-83		Muati	72	194	Q W Page	477
213	Acer Technology	346-341	532	DCA	498-497		Murphy	292	170	Rightsoft	478
214	Advanced Digital	351	533	Design Technology	278	228	Murphy Technology	292	170	Rightsoft	479
221	The Albridge Company	86	534	Digital Information Services	82	749	Muta Software	78	512	Seam On Computer	480
145	Any Computer Products	241		Disline	228-223		MicroSWEST	31	810	Seam On Computer	481
189	Arcon	460	280	Digital Products	560	300	Micro Systems	276	120	Seam Robotics & Co	482
189	American Power Conversion	563	143	Digital Research	248	300	MicroCom	296	154	Seaweed Corp	483
475	American Small Business	473	173	Digital Vision	248	300	Micro Interiors Corp	362	166	Seaweed Corp	484
193	Application Techniques	328	229	Digital Micro Products	148	202	MicroPress	73	128	Serv Technology	485
153	Archive	516-515	421	Digital Computer	488	366	Microtron	36	75	Shamrock	518-519
210	Arhinger Computer Products	779	279	Digital Pro Software	479		MicroSoft	29	123	Shamrock	520
208	Action Tech	358-359	177	Dynasoft Computer Prod	479		MicroSoft	29	123	Shamrock	521
208	ACT Research	311	330	Dynasoft Microprocessor Assist	479		MicroSoft	29	123	Shamrock	522
164	Autodesk	153	166	Electronic Wholesale	536		MicroSoft	493-493	523	Shamrock	523
245	Avnet	475	*	The Computing	444	290	Microtype	28	288	Shamrock	524
152	B & I	481	*	Eaton	4		Microtype	28	288	Shamrock	525
152	Barrington Systems	76	*	LTX Corporation	4		Microtype	28	288	Shamrock	526
261	Bay Express	530	286	Ferrari Generation	296-287		Microtype	488	354	Shamrock	527
261	Bay Technical Assoc	530	286	Ferrari Generation	296-287		Microtype	488	354	Shamrock	528
482	Bedford Software	82	180	Flagship Engineering	479	373	Mitabishi	137	*	Software Publishing	479
371	Bentley Computers	432-423	174	Form Worm	321	287	Mit Industries	526	215	Software Publishing	480
371	Best Programs	43	246	Fox & Geller	421	287	Minicomputer	129	129	Software Publishing	481
338	Byte Software	254-265	327	Frontier Tech	421	287	Minicomputer	129	129	Software Publishing	482
377	Borland International	15	203	Fu Fu America	480	741	Mitabishi	137	*	Software Publishing	483
377	Borland International	15	203	Fu Fu America	480	741	Mitabishi	137	*	Software Publishing	484
137	Borland International	15	203	Fu Fu America	480	741	Mitabishi	137	*	Software Publishing	485
477	Borland International	15	203	Fu Fu America	480	741	Mitabishi	137	*	Software Publishing	486
481	Building Computer Products	453-453	266	General Technology	445	*	NEC Home Electronics	426-425	158	System	487
484	Butterworth	108	505	Gensoft Software	818	742	NEC Home Electronics	426-425	158	System	488
125	Calsoft	246	472	Gensoft Software	818	742	NEC Home Electronics	426-425	158	System	489
351	Canon USA	440-441	275	Gensoft Engineering	324	247	NEC Home Electronics	426-425	158	System	490
349	Canon USA	168	368	Golden Rod	263	183	NEC Home Electronics	426-425	158	System	491
484	Cardinal Int'l	168	368	Golden Rod	263	183	NEC Home Electronics	426-425	158	System	492
337	CCOA	28	253	Golden Rod	263	183	NEC Home Electronics	426-425	158	System	493
120	Central Point Software	478	210	Hawthorne Computer Works	52	527	NEC Home Electronics	426-425	158	System	494
338	Chaswell	236	201	Hawthorne Computer Works	52	527	NEC Home Electronics	426-425	158	System	495
338	Chaswell	236	201	Hawthorne Computer Works	52	527	NEC Home Electronics	426-425	158	System	496
348	CIE Terminal	195	3	HDS Software	325	329	On-Line Systems	86-91	23	Toshiba	487
348	CIE Terminal	195	3	HDS Software	325	329	On-Line Systems	86-91	23	Toshiba	488
727	C. Digital Digital Products	485	287	Hewlett-Packard	364-363	283	PC Board	145	*	Trans Systems Inc	71
505	CUB AT	252-251	428	Hypertek	429	473	PC Connection	276-277	203	Trans Systems Inc	72
198	CMS	294	740	IBM Corp	473	260	PC Connection	283	423	Trans Systems Inc	73
188	Command Technology	371	300	InfoCom	575	496	PC Mart	416	191	Ultra Research	248
146	Compag Computer Corp	212-223	381	Information Products	575	496	PC Networks	504-507	83	Ultra Research	249
110	The Compuserp Corp	450	501	Intelligent Information Corp	329	355	PC Pickup	526	500	Ultra Research	250
224	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	251
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	252
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	253
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	254
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	255
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	256
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	257
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	258
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	259
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	260
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	261
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	262
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	263
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	264
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	265
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	266
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	267
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	268
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	269
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	270
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	271
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	272
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	273
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	274
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	275
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	276
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	277
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	278
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	279
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	280
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226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	282
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	283
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	284
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	285
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226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	288
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226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	290
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226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	292
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	293
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	294
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	295
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	296
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	297
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	298
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226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	300
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	301
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	302
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	303
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	304
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226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	306
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	307
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	308
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	309
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	310
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	311
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	312
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	313
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226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	315
226	CompuLink Corp	366-367	199	Intelligent Microcomputers	324-323	539	PC Limited	102-103	280	Ultra Research	316
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- a. Private Industry
- b. Government
- c. Education

2. Your primary job function is (check one):

- d. MIS/DP: Communications Systems, Programming
- e. Engineering/R&D
- f. Financial/Accounting
- g. Marketing/Sales
- h. Administrative/General Management

3. Is your company a reseller?

- i. Yes
- j. No

4. For how many IBM PCs and compatibles do you buy products?

- k. 10 or less
- l. 11-25
- m. 26-100
- n. 100 or more

5. Are PC's in your office

- a. Limited to mainframe
- b. Limited to mini
- c. Networked together

6. Does your company own

- s. Mainframe(s)
- t. Mini(s)

7. Do you plan to buy

- u. Now
- v. In 4 to 6 months
- w. In 6 to 12 months
- x. No definite plans

8. Number of employees in your company:

- y. 25 or less
- z. 26-99
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AFTER HOURS



FINE DINING

A Recipe File that Gives You a Head Start

BY DONALD TRIVETTE

Little Jack Horner, in his corner, may have happened on his Christmas pie plum quite easily, but the chef had to work at it.

If you're looking for a Christmas pie recipe, with or without plums, you might check

ings and numbers are missing. Woe to the chef who drops a stack of recipes. The directions for printing cards are sketchy at best (the secret is to set the page length to three index cards). Concept Development said it is working to improve the print feature.

The menu-driven program comes with a 92-recipe file called "A Taste for All Seasons," which is a potpourri of dishes ranging from Avocado Dip to Zesty Campana Salad—with things like New England Clam Chowder for the

library manager allows you to merge the individual disks into a giant cooking database—you'll need a hard disk, of course—from which you can then sort, search, select, and print a variety of virtuals. Using the edit feature you can add your own family recipes to the file; and with the select-and-mark feature you can compile, edit, and print a custom cookbook.

Although it's the best computer cookbook I've seen, *Micro Kitchen* compensates the slickness of most commercial databases. Of course, it's a lot less expensive than those products, and there's a wide variety of recipe disks available with more on the way.

Oh... the recipe for Christmas pie? As yet there is no Merry Olde England disk, and the only match for "plum" I could find was an ingredient in a recipe for barbecued spareribs from the Plum Blossom in Dallas, Texas.

List Price: *Micro Kitchen Manager*, Version 2.11, \$39.95; additional recipe disks, \$14.95. **Requires:** 256K RAM (a 128K abridged version is included), one disk drive, DOS 2.0 or later. Not copy protected. Concept Development Associates Inc., 45 Cordova St., St. Augustine, FL 32084; (904) 825-0220.

CIRCLE 606 ON READER SERVICE CARD

Micro Kitchen Manager lets you search and sort among recipes, some of which come from the PBS "Great Chefs" series; you're free to enter your own recipes or edit the dishes supplied.

4. POLISH JACOL	SOUP	STEWED CHICKEN	400-12-00	MAINE
5. POLISH JACOL	SOUP	STEWED CHICKEN	400-12-00	MAINE
22. SALAD W/ JACOL	SOUP	STEWED CHICKEN	400-12-00	MAINE
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92. SALAD W/ JACOL	SOUP	STEWED CHICKEN	400-12-00	MAINE

By Independent author. (Disked recipe, 0/10/11, 0/10/11, 0/10/11)

the *Micro Kitchen Companion* from Concept Development Associates. It's a combination cookbook/recipe management program that allows you to search a file of recipes by name, ingredients, source, keyword, and cuisine. Once you've found just the right dish, you can either display or print the results, which not only include directions and ingredients but also the estimated preparation time and degree of difficulty.

Each recipe consists of three parts: an index that gives its name, recipe number, source, cuisine, key ingredient, and a keyword describing the preparation technique, such as bake, fry, or boil; an ingredient list; and the directions. A print feature allows you to output individual, selected, or all recipes on paper or 4- by 6-inch index cards, although the card head-

less adventuresome. The recipes are from famous restaurants—Spago's in Los Angeles (Apple Tarts)—and from lesser-known establishments like the Jefferson Avenue Boarding Home in St. Louis, Missouri (Apple Compote). Most recipes serve six or eight, but a handy feature scales the quantities upward or downward to match your needs. The scaling is strictly mathematical. The savvy cook will take the quantities with a grain of salt and use, for example, 2 eggs instead of 2½ eggs.

Twelve other recipe disks are available from Concept Development for \$14.95 each, including Southern, Chinese, Italian, Mexican, and French cooking; the three newest recipe disks are companions to the popular PBS "Great Chefs" television series. A built-in li-



EDUCATION

Studymate Can Help You Pass the Test

BY CATHERINE D. MILLER

Whether you're pursuing graduate courses or helping your kids study, taking practice tests can help prepare for an exam. This not only ensures familiarity with the material but also helps simulate the experience of taking a test.

With *Studymate*, from Jackson Software, you can use your

PC as a partner to prepare for multiple-choice and terminology tests. Once you enter the course material, *Studymate* will quiz you for the answer exactly as you entered it or in a multiple-choice format.

You must feed *Studymate* with material as a list of pairs. A pair can consist of two words, two phrases, or a word and a phrase. For instance, if you're learning French, one list item might be the pair "ordinateur—computer."

In multiple-choice tests, *Studymate* picks the wrong choices from other items on the list to supplement the right choice. Or you can customize a multiple choice with specific wrong answers.

Although you can enter up to 200 pairs per list, it's best to keep your lists short because it's often easier to study your class material in smaller chunks. You can choose to combine several lists later.

Studymate lets you change the components of any list. You can add new pairs and delete pairs, as well as change the elements of a pair. However, it's just as easy to delete an item to be changed and enter the new pair as it is to change an item; you have to reenter both parts of the pair you choose to change.

Studymate lets you print review lists so you can study away from your computer.

Because you can store your lists, this program lends itself to situations where people are retested on a regular basis on the same basic material, such as for license renewals.

But what's really nice about *Studymate* is that you can use it to tailor your test preparation to meet your needs exactly—whatever your academic level.

List Price: *Studymate*, \$24.95. **Requires:** 128K RAM, DOS 2.0 or later. Copy protected. Jackson Software, P.O. Box 9101, Winitka, IL 60093; (312) 835-1921.

CIRCLE 605 ON READER SERVICE CARD



The ^{New} Entertainment Standard For IBM™ - PC's & Compatibles

In the early '80's, IBM computer owners couldn't find any "fun" software on the shelves to fill those "after business" hours... there just wasn't much out there. Then MicroSoft introduced "Flight Simulator", a great program that's trained a whole generation of armchair computer pilots and set the standard for IBM entertainment software.

But this is 1987... and software buyers with IBM-PC's and compatibles are now looking for a new challenge... searching for excitement... and innovation.

Well the search is over!

MicroProse Software presents... **GUNSHIP**... the attack helicopter simulation that sets a new standard of excellence in entertainment software for IBM-PC/compatible software.

Are you bored with simple line graphics? **GUNSHIP** displays filled, solid-object 3D graphics in fine detail and color.

Do you need more realistic flight characteristics? **GUNSHIP** gives you the industry's smoothest animation with a unique dynamic configuration system. The faster your machine operates, the smoother the flight and animation of graphics will be.

Are you tired of just flying around and looking at scenery? In **GUNSHIP**, you pilot an AH-64 Apache helicopter, the modern Army's most lethal weapon, on combat

missions that require split-second timing, lightning reflexes and intense concentration. Different skill levels make it easy to learn, but difficult to master.

So if you're tired of sightseeing and want to experience the exhilaration of high-tech combat flight simulation... look for **GUNSHIP**... the new entertainment standard for IBM-PC/XT/AT/PS2 and compatibles (not PC-Jr.).

GUNSHIP supports 320x200-line CGA (4 color), EGA (16 color) or Tandy (16 color) and can be operated using a joystick and/or keyboard controls. The simulation requires 256K of memory and can be installed on a hard disk drive.

GUNSHIP is available from a "Valued MicroProse Retailer" (VMR) near you. Call us for location! Suggested retail price \$49.95. If product cannot be found locally, call or write for MC/VISA order.



MICRO PROSE™
SIMULATION SOFTWARE

150 Lakeside Drive, Hunt Valley, MD 21096 • (301) 775-1511

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CIRCLE 292 ON READER SERVICE CARD

AFTER HOURS



HOBBIES

The Wrong Way to Build a Home Computer

BY WINN L. ROSCH

Some evening when you tire of running *Animal House* through your VCR again, you may be tempted to slide in *Build Yourself a Generic Computer*. After the obligatory copyright warning you'll see no chainsaws, no severed arms, and no aliens that look like something left too long in the refrigerator. Instead your screen will fill with genial Mark Wilson, who shows you how to put together an entire PC-compatible computer for under \$700, made from parts bought through magazine ads.

Like standard PBS fare, the tape comes across as a sort of "Crockett's Victory Garden" for computers, and Wilson projects the same sincerity and intellectual level as Mr. Rogers. If hardware for you is naught but "big screws" and "little screws," you'll have a wonderful time in Wilson's neighborhood.

I could overlook the style and presentation, were the content of the tape backed with depth and insight. However, Wilson assumes that every generic system board has exactly

the same chip layout, that all disk drives are the same, and that all PC-style hardware is the same. If you've ever tangled with the tumult from Taiwan, you know that it's not. The locations and even the nomenclature (if any) of parts differ widely between the products of different manufacturers.

Moreover, Wilson neglects some common pitfalls of assembly (such as forgetting to capture the power supply in the chassis tabs underneath) and otherwise fails to give sufficient direction to the uninitiated, for whom the tape seems aimed. For instance, the presentation would benefit tremendously from an on-screen parts list of everything you need for the project, a run-through of selection criteria, and some attention to different PC standards.

Worst is the price. Add the \$125 cost of the tape to the \$700 estimated computer construction price, and you could buy a better, fully assembled PC-compatible. For the price of the tape, Mark Wilson should come to your house and assemble your PC for you.

List Price: *Build Yourself a Generic Computer, Featuring Mark Wilson*, \$125.

Requires: VHS or Beta tape player. Meckler Video, 11 Ferry La. West, Westport, CT 06880; (203) 226-6967.

CIRCLE 686 ON READER SERVICE CARD

The same of Building Your self a Generic Computer is reassuring, but the lack of technical depth can be dangerous.



R.S.V.P. is a training tool for people with some foreign-language skills; here it tests for proper verb-subject and gender agreement.



LANGUAGES

Learn the Local Customs Before You Travel

BY PEGGY GAVAN

At home, conversation is a natural part of our daily routine. But what if you were in a foreign country? Would you find yourself asking directions to the nearest grocery store and ending up at an X-rated cinema, or ordering a steak only to find you had actually propositioned the maitre d'?

R.S.V.P. is an instructional language program designed to promote proficiency in communication while briefly introducing the user to the customs and colloquialisms of French- or Spanish-speaking countries. The program is also ideal for improving reading comprehension and mastering verb conjugations.

R.S.V.P. drills your foreign-language skills using 19 scenarios in the form of incomplete short dialogues. Your job is to read the dialogues and fill in missing letters, words, and phrases to complete the text. After completing the dialogue, you can then take a brief quiz to test your level of vocabulary comprehension.

To use R.S.V.P. successfully, you must be familiar with the language's vocabulary and syntax (many of the missing letters are in the form of pronouns and verb endings, so a good sense of grammar will help you get out of a tight spot). However, if you get stuck, help in the form of hints and word definitions is only a keystroke away. There is also a built-in editor that allows you to adjust the level of difficulty by adding and deleting missing letters or creating your own scenarios.

Although filling in missing letters is simple enough, the process is sluggish, as R.S.V.P. offers only the cursor control keys as a way of moving through the text. Of course, for a child who is not used to working with word processing commands, this makes the program that much easier to use.

No software program can replace the experience you get by visiting a foreign country and speaking to the natives. But if you are planning to visit France or even your local Mexican restaurant, R.S.V.P. can prepare you for the plunge into conversation.

List Price: R.S.V.P., \$59.95.

Requires: 256K RAM, DOS 2.0 or later. Not copy protected. Gessler Educational Software, 900 Broadway, New York, NY 10003; (212) 673-3113.

CIRCLE 687 ON READER SERVICE CARD

BEYOND

The *Zork Trilogy* has become a legend in its time, selling nearly one million copies! Now the legend continues with an extraordinary new Zorkian universe that breaks ground in computer gaming. For the first time, the character-building and combat of role-playing games joins the masterly prose and puzzles of Infocom's interactive fiction.

Beyond Zork's sophisticated new interface makes interaction more natural than ever, plunging you into a world teeming with magic and peril. The vast and varied Southlands of Quendor come alive as you seek fantastic treasure and combat the vicious monsters who haunt the streets and wastelands.

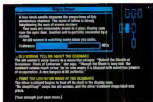
Challenge yourself to a quest that's far beyond anything you've ever experienced. *Beyond Zork*. The incredible new interactive story from the master storytellers at Infocom.

INFOCOM™

125 CambridgePark Drive, Cambridge, MA 02140

Beyond Zork is available at your local dealer for the Apple II series, Macintosh, Commodore 128, Amiga, IBM PC and 100% compatibles, and Atari ST. To order direct, call 1-800-262-6868. Coming soon: Apple IIGS.

Zork is a registered trademark of Infocom, Inc.



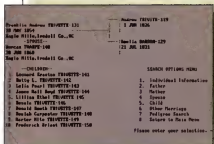
One glance at *Beyond Zork* will show you that it's unlike any interactive story you've seen before. On-screen mapping. Window displays. A character that grows in strength and power. You get all the excitement of role-playing games, skillfully blended with the fabulous puzzles and award-winning prose of Infocom's interactive fiction.

Screen shown is for the Commodore 128 version.



CIRCLE 300 ON READER SERVICE CARD

AFTER HOURS



An on-screen pedigree display showing my great-grandfather and some of his 11 children. The menu in the lower-right-hand corner allows movement forward or backward through the family.



GENEALOGY

How to Make Sense Out Of Your Family for \$35

BY DONALD TRIVETTE

In 1847 Brigham Young and a band of hearty followers settled in Utah around the Great Salt Lake and began practicing the Mormon religion, one of whose tenets is the collection and archiving of ancestral data.

So it should come as no surprise that modern-day Mormons have developed *Personal Ancestral File (PAF)*, an excellent genealogical program for the home computer.

More remarkable is the popularity of this software: 40,000 copies are in use, although it's not sold in retail stores or discount houses. The only way to get a copy is by calling or writing to the Distribution Center.

PAF is a specialized database for the recording and retrieval of genealogical information. The user interface is not high-tech, but rather the old-fashioned numerical list. Press 1 to add data, 2 to modify data, 3 to delete data, 4 for a pedigree search, and so on. This is both easy to use and quaintly refreshing to those of us accustomed to pop-up this and pull-down that.

The heart of PAF is the data

entry screen from which you enter sex, surname, three given names, and dates of birth, christening, marriage, death, and burial, as well as locations for each of those events. With all this data, the files would soon become quite large were it not for clever programming.

Since many of the names and places are frequently repeated, they are stored in a special file; any subsequent reference to a name that's already in the file is replaced by that name's ID number. For example, "Trivette" is recorded but once in the name file, even though I've entered hundreds of my ancestors in the database. All of this is transparent to the user; he or she simply enters names and the software does the rest.

Besides recording information, PAF has a variety of ways to give it back. There's an on-screen pedigree display from which you can navigate through the family, and if you want a hard copy of a list of your ancestors, the printed reports include pedigree charts, family group records, and descendant charts with an indented format.

List Price: *Personal Ancestral File*, Version 2.0, \$35.

Requires: 256K RAM, two disk drives, DOS 2.0 or later. Not copy protected. Distribution Center, 1999 W. 1700, South Salt Lake City, UT 84104; (800) 247-3892, ext. 5274; (801) 531-2584.

CIRCLE 600 ON READER SERVICE CARD



GAMES

Go: Territorial Battles As Recreation

BY PAUL V. OLOWACZ

The Japanese may not be keen on importing U.S. trade goods, but they pursue American pastimes with the same intensity that they bring to their work ethic. Crystalline Creations is now returning the compliment with *Nemesis*... *The Go Master*, a computer version of the national board game of Japan.

The object of Go is to capture territory by placing black and white stones on a wooden grid, thereby sealing off areas and surrounding your opponent's stones. It's simple to learn, but as difficult to master as chess—and much harder to adapt for the PC. Indeed, the Japanese Go Association once proclaimed it unprogrammable.

That is, until *Nemesis*, which is the strongest Go program to date. One thing's sure: at \$125, it's one of the most expensive games around.

The screen features a standard-size 19- by 19-line Go board. Smaller 13- and 9-line-square boards (for short games) are available as display options.

If you're in doubt about your next move, *Nemesis* is only too

happy to suggest one. As a very rusty Go player, I relied on this feature heavily and occasionally prevented *Nemesis* from beating the kimono off me.

Heavy emphasis is placed on the program's ability to teach the game. The booklet lays out the basic philosophy and tactics of Go strategy, while the screen offers tutoring in standard opening plays, or *joseki*. Games can be saved, and a board editor lets you replay situations or whole games. Even more helpful is the "motives" display, which gives a reason for each move *Nemesis* makes or suggests.

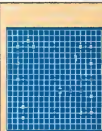
But here's where the learning system has some holes: the motives displayed keep lapsing into annoying humor, which ranges from the coy ("I need my disks cleaned") to the inscrutable ("It would have won against Ishida"), and the serious motives are full of unexplained terms.

Go is an exciting game, and *Nemesis* plays it very well. Though it's a flawed teacher, it still affords you a great chance to learn by playing.

List Price: *Nemesis*... *The Go Master*, \$125; upgrade, \$30 (free to registered users). Requires: 256K RAM, two disk drives, DOS 2.1 or later. Not copy protected. Crystalline Creations Inc., 34 Oak St., Lexington, MA 02173; (617) 863-1454.

CIRCLE 600 ON READER SERVICE CARD

Nemesis gives you the option of playing Go with or without its running commentary; in the upper-right-hand corner, it posts the last move and displays winning moves.



CIRCLE 376 ON READER SERVICE CARD

The most
helpful pointer
anyone's ever
given American
business.

```

DECLARE FUNCTION Filter$(Txt$, FilterMask$)

' Convert a number that contains non-numeric characters to
' a clean number.

' Input a line:
line INPUT "Enter a number with commas: "A$(error 1)

' Look for only valid numeric characters (0123456789.-) in the
' input string:
CleanNum$ = Filter$(A$, "0123456789.-")

' Convert the string to a number:
PRINT "The number's value = "; VAL(CleanNum$)
END

' Takes unwanted characters out of a string by
' comparing them with a filter string containing
' only acceptable numeric characters

FUNCTION Filter$(Txt$, FilterMask$(error 2))
(error 3) TxtLength = LEN(Txt$)

FOR I = 1 TO TxtLength%
(error 4) C$ = MID$(Txt$, I, 1) ' Isolate each character in
                                ' the string.
    ' If the character is in the filter string, save it:
    IF INSTR(FilterMask$, C$) <> 0 THEN
        Temp$ = Temp$ + C$
    END IF
NEXT I

Filter$ = Temp$
END FUNCTION

```

Get this program up and running in 5 minutes. Or your money back.

We don't expect to make many refunds, though. Thanks to a revolutionary breakthrough we call "instant programming." For the first time, you can run, test, debug, then continue running your BASIC program, and see the results instantly. All without a compile step interrupting your progress. Or your train of thought.

Try new Microsoft® QuickBASIC 4.0 on the program above. Or, on any program you'd like. If you can't go from paper to perfect execution faster than you ever imagined, return it within 30 days for a full refund. No questions asked.

But we're betting you'll enjoy a unique programming experience.

In our program, for example, Microsoft QuickBASIC 4.0's instant syntax checking will find the missing ";" (error 1) the instant you type in the line.

Of course, other BASICs will catch errors like this. Eventually. But none will catch the fact that integer variable *FilterMask%* (error 2) should be a string variable.

Let alone give you the incredible ability to edit and continue. For example, you can step through the FOR loop,

go back and correct *TxtLength's* missing "%" (error 3), then resume execution from that very statement.

Or allow you to monitor the changing value of *Temp\$* until you locate the especially subtle error number 4—the proper function call is *MID\$(Txt\$, I, 1)*—and, via our on-line help, confirm the fix by displaying *MID\$'s* syntax at the touch of a key.

What's more, at \$99, Microsoft QuickBASIC 4.0 boasts a sophisticated collection of professional features. From language extensions like records, recursion, huge arrays and true functions. To high-performance executable code that runs faster than output from the former speed champ. Our very own Microsoft QuickBASIC 3.0.

For the name of your nearest Microsoft dealer call (800) 541-1261, Dept. B23. Because without Microsoft QuickBASIC 4.0, you're waiting too long to see the results of your programming efforts.

And in this day and age, who wants to have a wait problem.

Microsoft® QuickBASIC 4.0